GEOTECHNICAL REPORT

SR 395 – NSLAC – Francis Avenue to US 2 Structures – Shady Slope Structures

XL-2201

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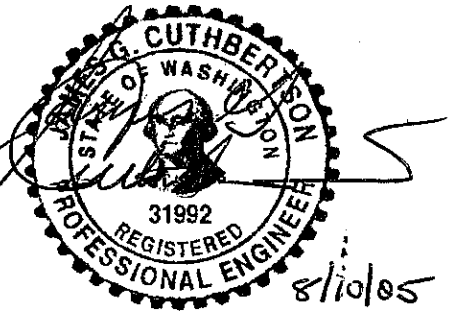

EXPIRES 03-13-06

August 10, 2005

Washington State Department of Transportation
Douglas MacDonald
Secretary of Transportation

Environmental and Engineering Programs Division
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1. INTRODUCTION

1.1. GENERAL

This report presents the results from a geotechnical study performed for the SR 395, North Spokane Limited Access Corridor (NSLAC), Francis Avenue to US 2 Structures project. The location of the project site is shown on the Vicinity Map, Figure 1 in Appendix A.

The analyses, conclusions, and recommendations provided in this report are based on our understanding of the project and site conditions existing at the time of our site review and field exploration program. The exploratory borings are assumed to be representative of the subsurface conditions at locations throughout the site. If during construction, subsurface conditions differ from those described in the explorations, we should be advised immediately so that we may reevaluate our recommendations and provide assistance.

This report should be made available to prospective bidders and the contractor in accordance with Section 1-02.4 (2) of the Standard Specifications.

1.2. PROJECT DESCRIPTION

The NSLAC project is located in northeast Spokane, between the Spokane River Bridge and the Little Spokane River. The project will entail construction of approximately nine miles of new, four to eight lane highway, up to seven interchanges, and their associated structures. The purpose of the project is to improve mobility through the city of Spokane and Spokane County between Interstate 90 (I-90), US 2, northeastern Washington, and Canada.

The project is divided into a number of sections for the purpose of design and construction. The Francis Avenue to US 2 Structures project will construct a series of bridges between Gerlach Road and Perry Street. This memorandum provides foundation recommendations for the US 2 Undercrossing at Shady Slope and the US 395 Undercrossing at Shady Slope. These bridges will be two-span, post tensioned concrete box girder structures. We understand this bridge type is relatively intolerant to differential settlements between the bridge piers. Retaining walls will provide for the transition from approach fills to the bridge abutments.

1.3. PREVIOUS STUDIES

Information on other geotechnical work performed in the project vicinity is included in the following reports:

- *Geotechnical Data Report, SR 395 – North Spokane Corridor, Section 1 – Hawthorn Road to US 2, Spokane, Washington*, prepared by Landau Associates Inc., February 6, 2001.
- *Geotechnical Data Report, SR 395 – North Spokane Corridor, Section 2 – From US 2 to SR 395*, prepared by Landau Associates Inc., March 26, 2001.
- *Geotechnical Data Report, SR 395 – North Spokane Corridor, Section 3 Spokane, Washington*, prepared by Landau Associates Inc., May 23, 2001.
- *US Highway 2 Groundwater Study, SR 395 North Spokane Corridor Project, Spokane Washington*, prepared by Landau Associates Inc., 2001.

2. PROJECT SUBSURFACE CONDITIONS

2.1. REGIONAL GEOLOGY

Bedrock and sedimentary units in the project area include, from oldest to youngest: Metamorphic and igneous rocks, the Latah Formation and Columbia River Basalt Group,

Lake Missoula catastrophic flood deposits, and eolian deposits. These units are described in the following paragraphs.

The Spokane area is underlain by high-grade metamorphic rocks of the Spokane dome of the Priest River metamorphic core complex. The core rocks have been intruded by Cretaceous and early Tertiary granitic rocks. These rocks were deeply eroded, leaving a surface of considerable relief that forms a generally northwest trending mountain range with drainages extending into the lowlands to the south.

During the Miocene Epoch (late Tertiary), between 5 and 24 million years ago, extensive flows of basaltic lava flooded the region, covering the lower valleys and foothills and abutting the higher mountains. The basalt flows covered more than 100,000 square miles in parts of Washington, Idaho, and Oregon. Two formations of the Columbia River Basalt Group have been mapped in the area: the Wanapum Basalt (Priest Rapid Member) and the Grande Ronde Basalt. The Grande Ronde Basalt is between 15 and 16 million years old, and is generally designated as "valley" flows due mainly to exposures in valleys around the Spokane area. The Wanapum Basalt is between 15 and 14 million years old and is generally designated as "rim rock" flows mainly because it caps the bluffs in the project area.

The Columbia River basin is generally thought to be arcuate in shape, extending from near Grand Coulee, Washington to Moscow, Idaho. Lacustrine sediments, derived from erosion of the older basalts and the pre-Tertiary rocks in the region, were deposited in the basin. These sediments, consisting of primarily silt and clay, with minor sand and gravel, form the Latah Formation. The Latah Formation is generally described as poorly indurated siltstone, claystone, sandstone, and minor conglomerate, containing scattered volcanic ash layers. Little data is available regarding the general depositional nature of the Latah Formation, but sediment was likely deposited by drainages flowing into the basin from the east and north. Where exposed in the Spokane region, the Latah Formation generally overlies the Grande Ronde Basalt and underlies the Wanapum Basalt.

During the Pleistocene Epoch (early Quaternary), 10,000 to 2 million years ago, vast continental ice sheets periodically advanced into the Spokane valley. The latest advance, which occurred between about 12,000 and 22,000 years ago, had the greatest effect on the present day landscape. Melt water deposits, chiefly of sand and gravel, with silt and clay, were deposited in and along the valleys of the Little Spokane and Spokane Rivers. In addition, a proglacial lake, known as Lake Columbia, occupied much of the Spokane Valley during the Pleistocene. Remnants of the lake sediments exist in tributary valleys such as the Peone Prairie north of Spokane (east of the project area). The glacial lake deposits consist predominantly of sand, silt and clay with scattered drop stones.

Glacial ice of the Purcell lobe is thought to have periodically blocked the Clark Fork River near the present day Idaho/Montana border, forming a great ice dam across the valley. Melt water from other ice lobes further up the Clark Fork River drainage became impounded behind the ice dam, forming a vast lake in present-day western Montana referred to as Glacial Lake Missoula. Periodically the ice dam failed, releasing an enormous volume of water that flowed across the landscape. The majority of this flood water rushed through the Spokane River and Little Spokane River valleys en route to the Columbia River.

Though the number of Pleistocene flood events are unknown, each flood event likely swept down the Spokane and Little Spokane River valleys scouring deposits of the previous flood events, cutting new channels into the pre-Pleistocene bedrock, and leaving behind new

deposits of boulders, cobbles, gravel, and sand. In less energetic environments, slack water deposits of chiefly sand and lacustrine sediments were laid down.

Surficial deposits of wind-blown sand (Holocene [present to 10,000 years ago] and Pleistocene Epoch) are present over the flood deposits over much of the project area, south of Farwell Road. The wind-blown deposits (dunes) are derived primarily from Pleistocene flood deposits that mantle much of the project area.

As part of this study, we reviewed available geologic data for the project vicinity. The geologic map of the site, titled *Geologic Map of the Spokane 1:100,000 Quadrangle, Washington-Idaho* (Joseph, 1990), indicates the project area is underlain by flood deposits. These deposits generally consist of silty sands and gravels interbedded with lenses of silt and clay.

2.2. FIELD EXPLORATION

Subsurface exploration for this project consisted of advancing one or more exploratory borings at or near the proposed location of each bridge pier. Our field exploration was conducted in general accordance with the 2003, *Checklist and Guidelines for Review of Geotechnical Reports and Preliminary Plans and Specifications,* FHWA publication ED-88-053. Appendix B contains copies of the boring logs and a detailed discussion of our exploration program. All boring logs should be made available to prospective bidders and included in the contract documents. Appendix C provides a discussion of the laboratory testing program and applicable test results.

2.3. SOIL CONDITIONS

Based on our exploration program and laboratory testing, there are two general soil units underlying the proposed bridges, which is generally consistent with available geologic mapping. These soil units are described below in more detail:

Unit 1 – Flood Deposits: This unit consists of loose to dense, poorly and well graded sand and silty sand separated by lenses of interbedded silts and clays. One small boulder was encountered in boring SS-1-04.

Unit 2 – Latah Formation: This unit consists of medium dense to dense silt with sand and elastic silt. This unit was only encountered in the vicinity of Piers 2 and 3 of the US 395 Undercrossing at Shady Slope.

2.4. GROUNDWATER

Groundwater was recorded at various elevations throughout the project site. Based on the *US Highway 2 Groundwater Study, S.R. 395 North Spokane Corridor Project, Spokane, Washington,* by Landau Associates, Inc., groundwater in the project area consists of numerous, discontinuous perched water tables. Lenses of groundwater are trapped above the lenses of silts and clays within the flood deposits. In general, the perched water tables tend to be less than 5- to 8-feet thick and of limited lateral extent. Within the limits explored for these bridges, there is no evidence of a permanent, regional groundwater table or perched water tables that may impact construction.

3. SEISMOLOGICAL CONSIDERATIONS

3.1. DESIGN EARTHQUAKE PARAMETERS

For seismic design, a peak bedrock acceleration coefficient of 0.06 is recommended based on the 2002 US Geological Survey National Seismic Hazards Mapping project. The recommended acceleration coefficient is based on expected ground motion at the project site that has a 10 percent probability of exceedence in a 50-year period (475-year return period). Design response spectra presented in the AASHTO guide specifications for seismic design of highway bridges are considered appropriate for seismic design of these bridges. A type II Soil Profile response spectrum, with a Site Coefficient of 1.2 is recommended for seismic design.

3.2. SEISMIC HAZARDS

Soil liquefaction is a phenomenon whereby saturated soil deposits temporarily lose strength and behave as a viscous fluid in response to cyclic loading. Soil types considered at the highest risk of liquefaction during a seismic event are loose to medium dense, sandy soils. While other studies have indicated these soils do exist within the project corridor limits, they were not encountered at the structures addressed in this report. Consequently, we do not anticipate any ground settlement or lateral spreading to occur following a design seismic event.

4. BRIDGE FOUNDATION RECOMMENDATIONS

4.1. GENERAL

We understand the bridges associated with this project will be designed using Load and resistance Factored Design (LRFD) methodology. Both of the bridges will be post-tensioned box girder bridges. Based on the soil conditions observed during our field exploration program, and the structure type, we recommend driven piles be used to support the bridges.

Drilled shafts are also a suitable foundation type. However, we understand there are more contractors in the Spokane area with pile driving experience and driven piles will likely be less expensive than drilled shafts. If Eastern Region or the Bridge and Structures Office determine drilled shafts may be less expensive, we can prepare design recommendations for drilled shafts. Spread footings are not considered suitable for supporting these bridges due to the anticipated settlement and relative intolerance of post-tensioned box girder bridges to settlement.

4.2. DRIVEN PILE FOUNDATIONS

Appendices D and E provide LRFD capacity charts and P-Y input data for the US 2 Undercrossing at Shady Slope and the US 395 Undercrossing at Shady Slope, respectively. We have provided axial capacity charts for 18- and 24-inch steel pipe piles, driven closed ended. Due to varying soil conditions, we have provided separate capacity charts for each pier of each bridge. Table 1 provides resistance factors for the Strength, Service, and Extreme Event Limit States.

Table 1: Resistance Factors for Pile Design

	Strength Limit State	Service Limit State	Extreme Event Limit State
Axial Compression	0.55	1.0	1.0
Uplift Resistance of Single Piles	0.35	1.0	0.8
Group Uplift Resistance	0.50	1.0	0.8
Horizontal Geotechnical Resistance	1.0	1.0	1.0

Table 2 provides minimum tip elevations for each pier. These minimum tip elevations are provided to ensure the piles extend below potentially compressible soil units and into competent soils. These values should be cited in the contract special provisions or shown in the contract plans. The required nominal driving resistances provided by the Bridge and Structures Office are listed in Table 2. Based on the nominal driving resistance to meet structural requirements, overdriving is anticipated at most of the piers in order to reach the specified minimum tip elevation. The anticipated overdriving is provided in Table 2. These values should be included in the Contract Provisions so the Contractor can provide an adequately sized pile driving hammer.

Table 2: Minimum Tip Elevations

	Minimum Tip Elevation	Nominal Driving Resisance (kips)	Anticipated Overdriving (kips)
US 2 Undercrossing at Shady Slope			
Pier 1	1774 feet	900	100
Pier 2	1778 feet	900	100
Pier 3	1789 feet	900	100
US 395 Undercrossing at Shady Slope			
Pier 1	1797 feet	700	385
Pier 2	1802 feet	700	300
Pier 3	1817 feet	700	0

Lateral analysis of driven piles can be evaluated using the LPILE computer program (Reese & Wang, 1989). P-Y curve soil parameters used for the LPILE input are presented in Appendices D and E.

For lateral analysis of foundation elements in a group, reduction factors should be used if P-y methods of analysis are used. The values of P should be multiplied by the values, P_m, in Table 3 to modify the P-y curves used in the analysis. The multipliers, P_m, in Table 3 are a function of the center-to-center spacing expressed in multiples of the foundation element diameter (D) as measured along the direction of loading within the group. The values of P_m in Table 3 were developed for vertical elements only. Note that P_m is not applicable if strain wedge theory is used.

Table 3. Load Modifiers, P_m, for Multiple Row Shading (averaged from Hannigan, et al., 1997).

Center-to-Center Spacing In the Direction of Loading	P Multipliers		
	Row 1	Row 2	Row 3 and Higher
3D	0.70	0.50	0.35
5D	1.00	0.85	0.70

Loading direction and spacing are as defined in Figure 1. Note that if the loading direction for a single row is perpendicular to the row (bottom right detail in the figure), a group reduction factor of less than 1.0 should only be used if the spacing is 5D or less, as shown in the detail.

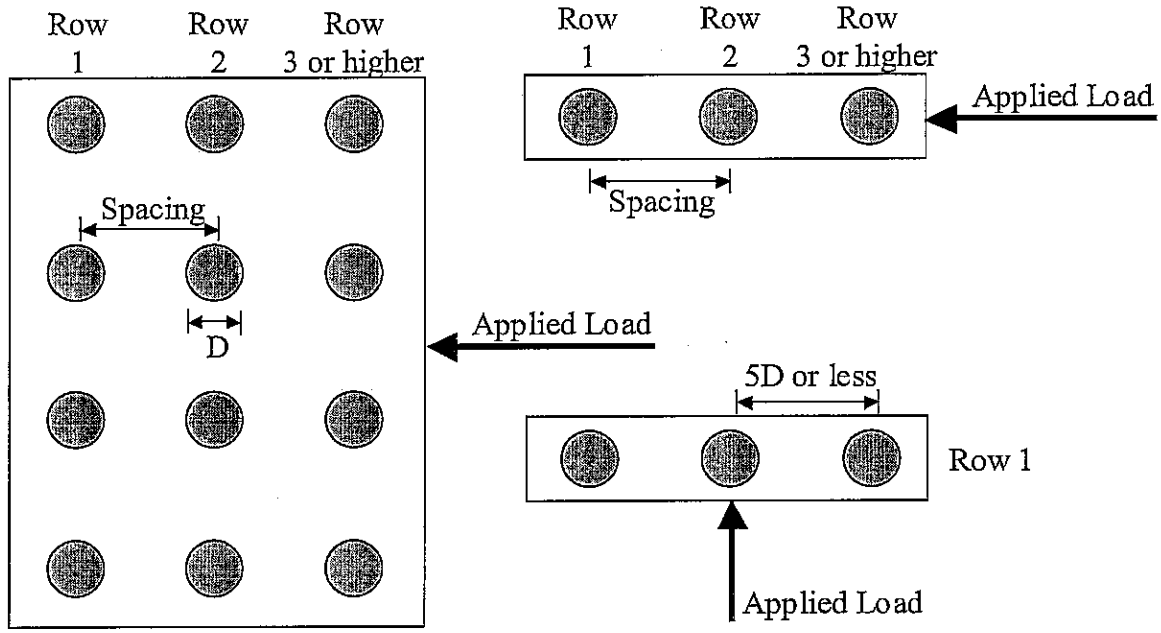

Figure 1. Definition of loading direction and spacing for group effects.

4.2.1. Approach Embankments/Surcharge

Construction of the approach embankments at Piers 1 and 3 of the US 2 Undercrossing at Shady Slope and at Pier 3 of the US 395 Undercrossing at Shady Slope will result in settlement ranging from 1 to 3 inches in the vicinity of the bridge piers. While most of the settlement will be immediate, and will occur during embankment construction, thin clay seams will result in some post-construction settlement. We estimate post construction settlement will be less than ½" and will occur within 60 days.

Construction of the approach embankments after bridge construction will result in down-drag loads on the driven piles. Based on our analysis, the down-drag loads would make driven piles or drilled shaft foundations impractical and costly without some form of ground improvement. While an extensive ground improvement program may be used to allow the use of spread footings to support the bridges, we believe the most cost effective solution is to surcharge the existing ground by constructing the approach embankments prior to installing the driven piles. The approach embankments plus some additional embankment should be constructed at Piers 1 and 3 of the US 2 Undercrossing at Shady Slope and at Pier 3 of the US 395 Undercrossing at Shady Slope. The embankments should be constructed to the final grade elevations out to the proposed bridge seats. The embankment should then be sloped to existing ground at a 2:1 (Horizontal:Vertical) slope. A portion of the material would then need to be removed to allow for bridge construction. The surcharge should be allowed to remain in place for a minimum of 60 days.

4.2.2. Service Limit State Settlement

We have calculated the Service Limit State settlements at each pier based on the subsurface conditions, and the loads and pile group dimensions provided by the Bridge and Structures Office. At the minimum tip elevations recommended above, we estimate settlements of less

than or equal to 1 inch at each of the piers for both the US 2 undercrossing at Shady Slope and the US 395 undercrossing at Shady Slope. Differential settlements between piers are anticipated to be less than ¼-inch.

4.3. ABUTMENT WALLS

The soil properties provided in Appendix D should be used to determine earth pressures acting on the abutments of both structures. These parameters should be used in accordance with the design methodology presented in the *Bridge Design Manual* for abutments. The static earth pressures cited in Appendix D should be applied as a triangular load to the pier cap. The seismic earth pressures should be applied as a rectangular load to the pier cap. Resistance to the earth pressure should be calculated using the LPILE computer program; passive earth pressure on the front face of the pier cap should not be considered.

The lateral earth pressure due to traffic surcharge loading can be calculated using a uniformly distributed load at the ground surface of 250 psf, multiplied by K_a (K_a x 250 psf), or 65 psf.

4.4. BRIDGE APPROACH SLABS

Section 8.6.5.3 of the forthcoming *WSDOT Geotechnical Design Manual* requires the use of approach slabs where approach embankments exceed 8 feet in height. We recommend approach slabs be used at Piers 1 and 3 of the US 2 Undercrossing at Shady Slope and at Pier 3 of the US 395 Undercrossing at Shady Slope.

Pier 1 of the US 395 Undercrossing at Shady Slope will be constructed in a cut situation. There are no geotechnical reasons for constructing an approach slab at this location.

5. RETAINING WALL RECOMMENDATIONS

5.1. GENERAL

Four retaining walls are proposed at each bridge to transition from the approach fills to the bridge abutments. The proposed walls will be fill walls supporting Shady Slope Road. The location of the walls are shown on Figures 2 and 4. Table 4 provides a summary the wall designations, locations, and maximum heights.

Table 4. Wall Designations, Locations, and Heights

Wall	Location	Height (ft.)
US2 Wall 1	SS 17+85.74 (24' Rt.) to SS 18+03.74 (24' Rt.)	6
US2 Wall 2	SS 20+92.74 (24' Rt.) to SS 21+38.74 (24' Rt.)	18
US2 Wall 3	SS 17+85.74 (24' Lt.) to SS 18+03.74 (24' Lt.)	7
US2 Wall 4	SS 20+92.74 (24' Lt.) to SS 21+18.74 (24' Lt.)	9
US395 Wall 1	SS 22+54.57 (24' Rt.) to SS 22+88.74 (24' Rt.)	10
US395 Wall 2	SS 26+55.23 (24' Rt.) to SS 26+67.65 (24' Rt.)	7
US395 Wall 3	SS 23+05.39 (24' Lt.) to SS 23+16.99 (24' Lt.)	4
US395 Wall 4	SS 26+69.14 (24' Lt.) to SS 26+80.76 (24' Lt.)	6

If the location, height, or alignment of these walls changes significantly prior to construction, we should be notified so we can reevaluate our recommendations and provide assistance. A significant change would include an increase in height of more than 5 feet, an increase in

length of more than 25 feet, or a change in wall location (with respect to the centerline alignment) of more than 25 feet.

5.2. PERMANENT GEOSYNTHETIC RETAINING WALLS

We understand Eastern Region would prefer to use Standard Plan D-3 Geosynthetic Walls for this project. Geosynthetic walls are suitable and can be used for all of the walls listed in Table 4. The Type 4 Wall shown in Standard Plan D-3 provides adequate reinforcing length to meet required factors of safety for bearing capacity, sliding, overturning, and global stability. Settlements are anticipated to be less than 1 inch, and occur during construction. Post-construction settlements are anticipated to be negligible.

Currently, the Standard Plans only provide cast-in-place concrete and shotcrete wall face options. From a geotechnical standpoint, precast concrete fascia panels are also feasible. A precast panel option will require a special structural design.

5.3. STRUCTURAL EARTH WALLS

Proprietary structural earth (SE) walls that have been pre-approved by WSDOT are also suitable for the walls listed in Table 4. Design parameters for inclusion in the General Special Provision titled *Structural Earth Walls*, are as follows:

Soil Parameters	Wall Backfill	Retained Soil	Foundation Soil
Unit Weight (pcf)	130	125	125
Friction Angle (deg)	36	36	34
Cohesion (psf)	0	0	0

Foundation Soil	AASHTO Load Group I	AASHTO Load Group VII
Allowable Bearing Capacity (psf)	7,000	14,000
Acceleration Coefficient (g)	0	0.06

A traffic surcharge of 250 psf should be added when designing the wall.

The SE wall system should meet the following requirements.

1. The wall should be placed on a level (in direction perpendicular to the wall face) and firm foundation. Walls can be allowed to slope along their length up to 4H:1V (horizontal:vertical) or be stepped in accordance with the manufacturers recommendations to match a steeper slope.
2. Wall face batter should be no steeper than 1H:48V.
3. The base width of the wall should be greater than or equal to 70 percent of the wall height.
4. The top reinforcing layer should be placed no lower than 2 feet below the top of the wall.

5. Wall embedment should be at least 2 feet or 10 percent of the wall height, whichever is greater.
6. Provisions for permanent control of subsurface water behind the wall should consist of a slotted drain pipe embedded in Gravel Backfill for Drains (Section 9-03.12(4)) as shown in Design Manual Figure 1130-2.
7. Drainage structures should be located outside the reinforced zone where possible. If drainage structures are planned within the reinforced zone, they must be shown on the plans and profile sheets provided to the wall proprietor so they can account for the structures in their design. If drainage structures are located behind the face of a SE wall, the outfall pipe should run perpendicular to the wall face.

Settlements are anticipated to be less than 1 inch, and occur during construction. Post-construction settlement will be negligible.

Prior to contract advertisement, the Project office should contact each of the wall proprietors listed in the General Special Provisions to confirm that they want to be included in the contract.

6. CONSTRUCTION CONSIDERATIONS

Our subsurface investigation encountered one boulder in boring SS-1-04. Based on the site geology, we do not anticipate a significant amount of boulders, however they may be encountered during pile driving. The Contractor should be prepared for difficult driving conditions. We believe the piles can be driven with flat plates on the pile tips.

Perched groundwater tables have been encountered in the vicinity of the US2/US395 interchange. While the field explorations indicate groundwater should be well below the excavations for the bridge foundations, groundwater may be encountered depending on time of year, precipitation, or other factors. Where pile cap elevations are below existing ground, we recommend construction take place in the drier late summer or early fall months.

APPENDIX A

FIGURES

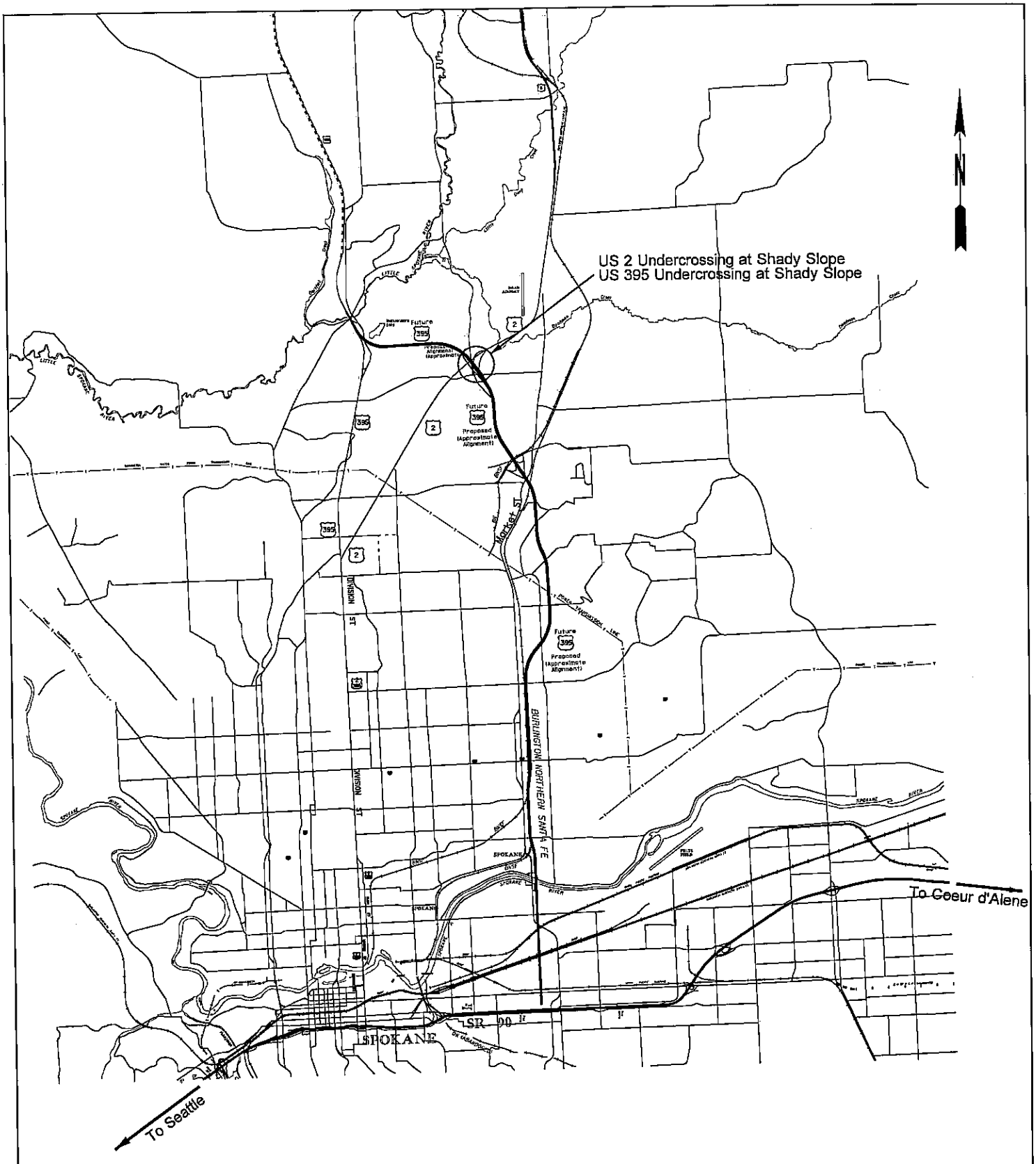

FIGURE 1: SITE VICINITY MAP

JOB XL-2201 S.R. 395 C.S. 3208 LAYOUT

SR 395 North Spokane Corridor
Francis Avenue to US-2 Structures

WASHINGTON STATE
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DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 1/2005
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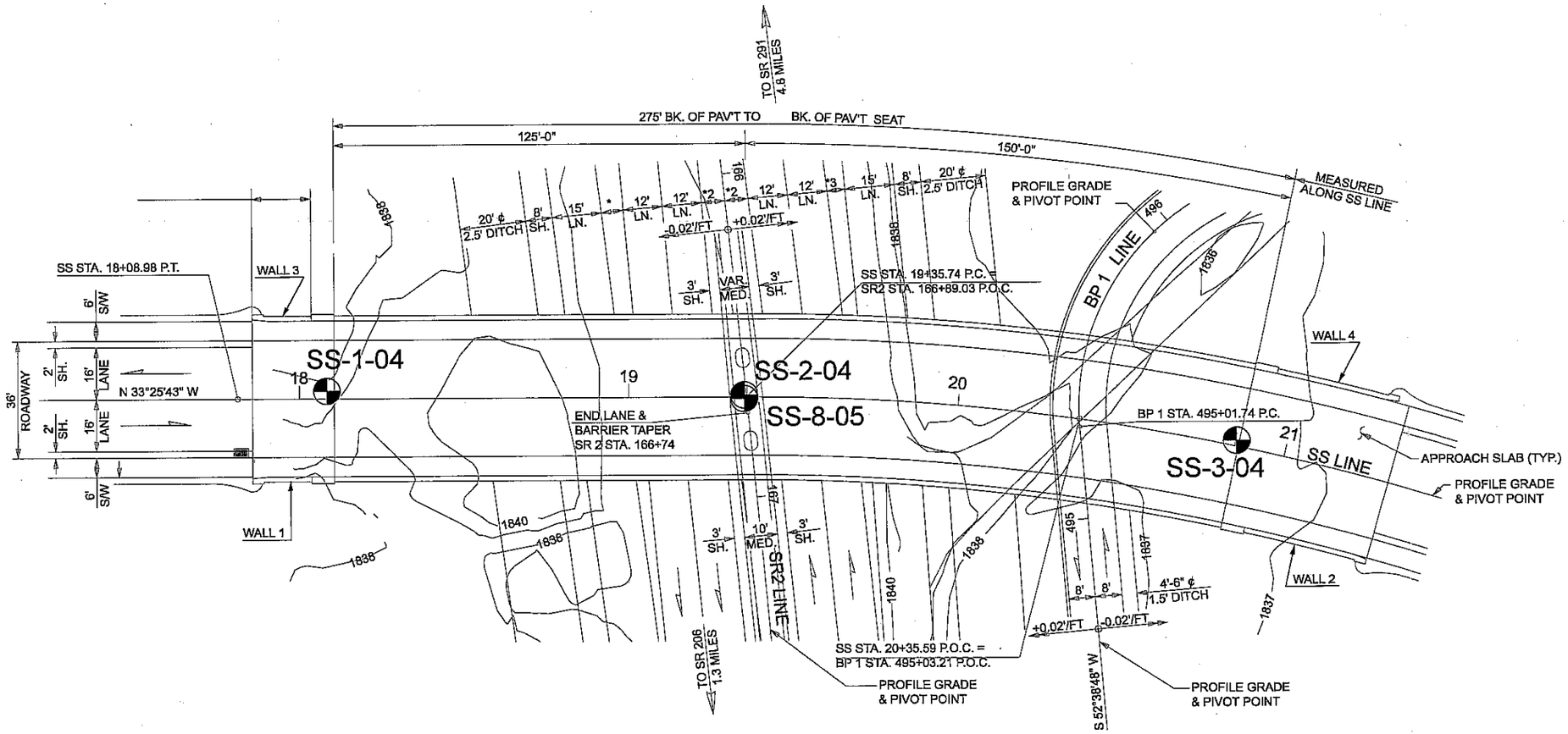

Figure 2: Site and Exploration Plan
US-2 Undercrossing at Shady Slope

JOB XL-2201 S.R. 395 C.S. 3208 LAYOUT

SR 395 North Spokane Corridor
Francis Avenue to US-2 Structures

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

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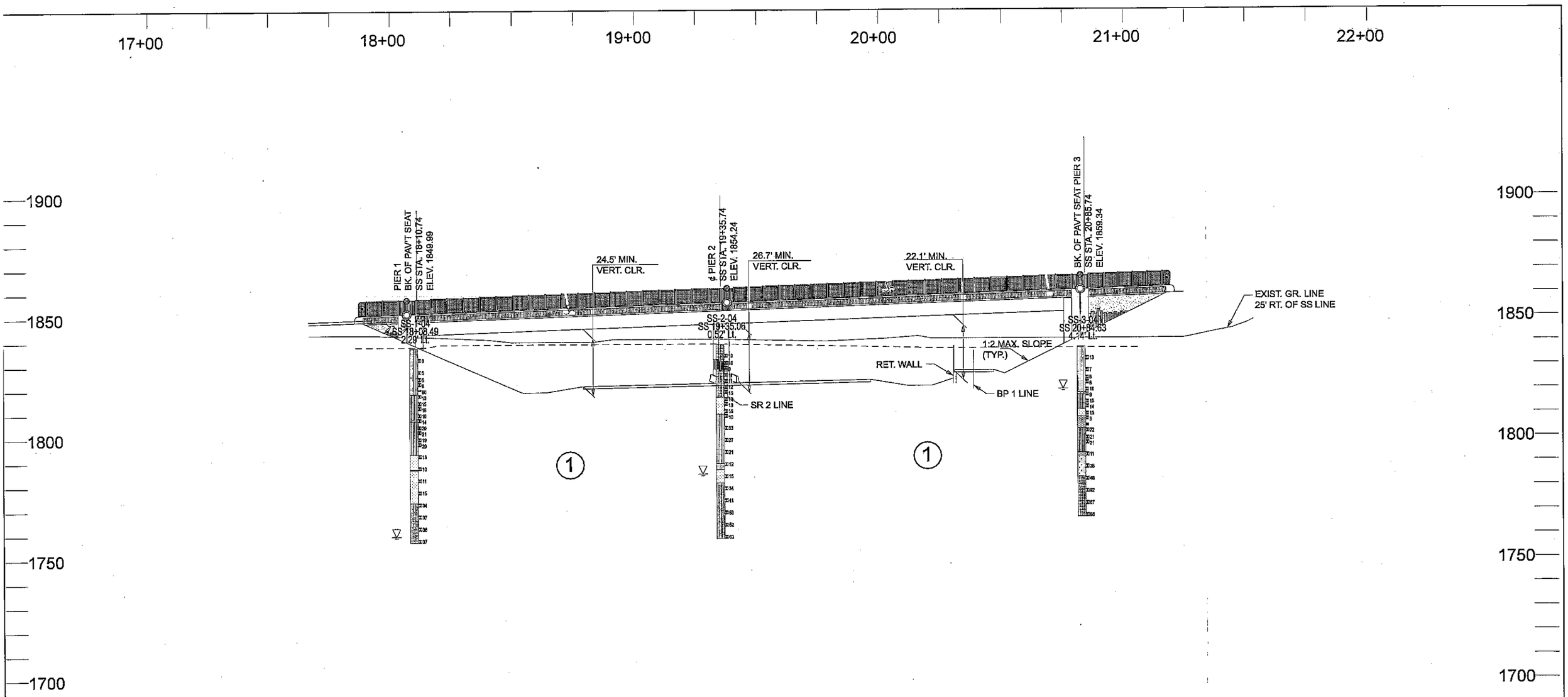

TEST HOLE LEGEND

H-I-04 TEST HOLE NUMBER
110+55 TEST HOLE STATION
26 ft.Rt. TEST HOLE OFFSET
23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)
8/5/04 ▽ WATER LEVEL & DATE
UNDISTURBED SAMPLE
SOIL/ROCK STRATA AS DEFINED ON BORING LOG
100 INDICATES CORE SAMPLE TAKEN
ROCK QUALITY DESIGNATION IN %

(1) Loose to dense, poorly and well graded SAND and Silty SAND separated by lenses of interbedded silts and clays (flood deposits).

Figure 3: Generalized Geologic Profile
US-2 Undercrossing at Shady Slope

JOB XL-2201 S.R. 395 C.S. 3208 LAYOUT

SR 395 North Spokane Corridor
Francis Avenue to US-2 Structures

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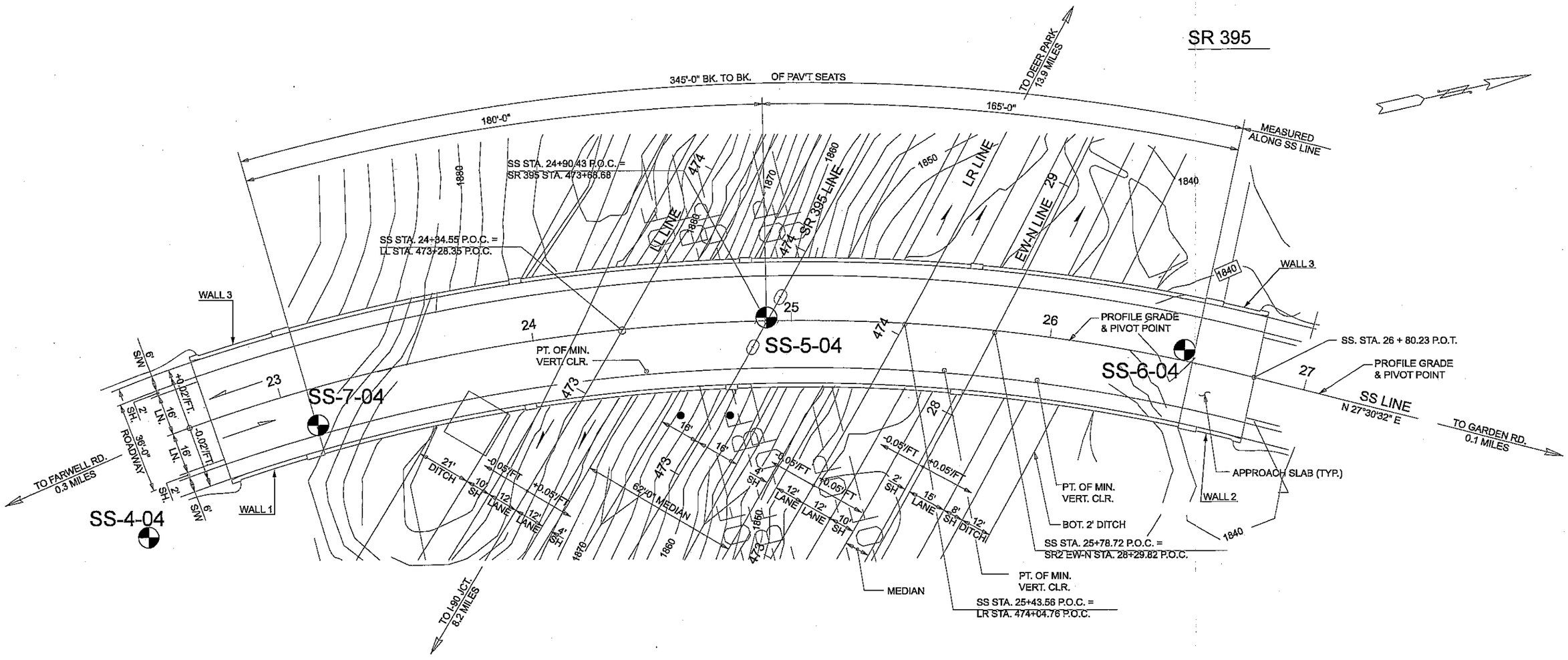

Figure 4: Site and Exploration Plan
US-395 Undercrossing at Shady Slope

JOB XL-2201 S.R. 395 C.S. 3208 LAYOUT

SR 395 North Spokane Corridor
Francis Avenue to US-2 Structures

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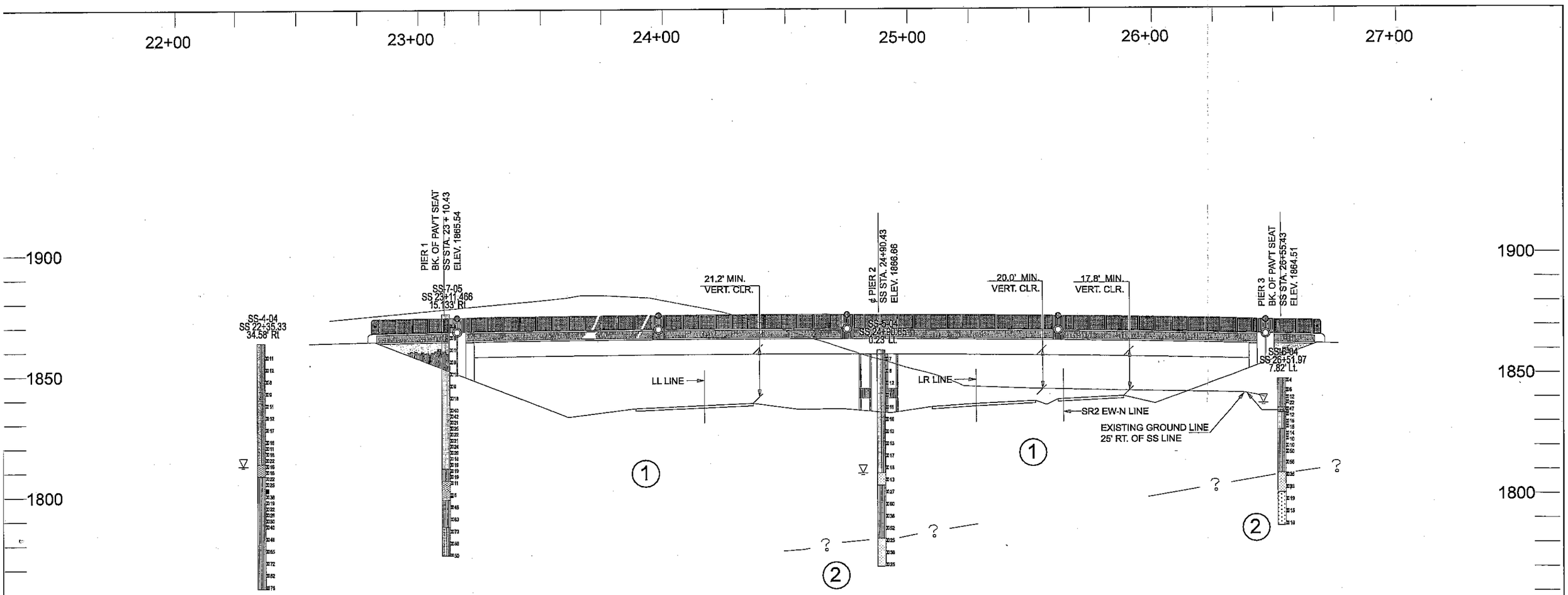

TEST HOLE LEGEND

H-I-04 TEST HOLE NUMBER
110+55 TEST HOLE STATION
26 ft.Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)

8/5/04 ▽ WATER LEVEL & DATE

UNDISTURBED SAMPLE

SOIL/ROCK STRATA AS DEFINED ON BORING LOG

100 INDICATES CORE SAMPLE TAKEN

ROCK QUALITY DESIGNATION IN %

① Loose to dense, poorly and well graded SAND and Silty SAND separated by lenses of interbedded silts and clays (flood deposits).

② Medium dense to dense SILT with sand and elastic silt (Latah Formation)

Figure 5: Generalized Geologic Profile
US-395 Undercrossing at Shady Slope

JOB XL-2201 S.R. 395 C.S. 3208 LAYOUT

SR 395 North Spokane Corridor
Francis Avenue to US-2 Structures

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DATE 1/2005
SCALE 1"=40' VERT. HORIZ.
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APPENDIX B

FIELD EXPLORATIONS

FIELD EXPLORATIONS

WSDOT's field exploration program for the Francis Avenue to US 2, Structures project consisted of drilling 8 exploratory borings.

Geotechnical drilling was performed using a CME 850 track-mounted drilling rig and a CME-45 skid-mounted drill rig. Test holes were advanced to depths up to 100 feet below the ground surface principally using mud rotary drilling methods. At each location, soil samples were obtained using a SPT (Standard Penetration Test) sampler, in general accordance with ASTM D-1586. SPTs are obtained by driving a 2-inch outside diameter split-spoon sampler 18-inches into the soil with a 140-pound hammer. The number of blows required to achieve each 6 inches of penetration is recorded and the soil's SPT resistance, or N-value, is calculated as the number of blows required to achieve the final 12 inches of penetration. Each drill rig is equipped with an automatic trip hammer to drive the split-spoon sampler. The automatic hammers on these two drill rigs are rated at approximately 80 percent efficiency, as compared to approximately 60 percent for manual hammers.

Select soil samples were then submitted to the E&EP Materials Laboratory for laboratory testing.

Washington State Department of Transportation

Test Boring Legend

Sampler Symbols

	Standard Penetration Test
X	Oversized Penetration Test (Dames & Moore, California)
	Shelby Tube
P	Piston Sample
	Washington Undisturbed
	Vane Shear Test
	Core
	Becker Hammer
B	Bag Sample

Well Symbols

	Cement Surface Seal
	Piezometer Pipe in Granular Bentonite Seal
	Piezometer Pipe in Sand
	Well Screen in Sand
	Granular Bentonite Bottom Seal
	Inclinometer Casing in Concrete Bentonite Grout

Laboratory Testing Codes

UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
UC	Unconfined Compression Test
DS	Direct Shear Test
CN	Consolidation Test
GS	Grain Size Distribution
MC	Moisture Content
SG	Specific Gravity
OR	Organic Content
DN	Density
AL	Atterberg Limits
PT	Point Load Compressive Test
SL	Slake Test
DG	Degradation
LA	LA Abrasion

Soil Density Modifiers

Gravel, Sand & Non-plastic Silt		Elastic Silts and Clay	
SPT Blows/ft	Density	SPT Blows/ft	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-24	Medium Dense	5-8	Medium Stiff
25-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		31-60	Hard
		>60	Very Hard

Angularity of Gravel & Cobbles

Angular	Coarse particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Coarse grained particles are similar to angular but have rounded edges.
Subrounded	Coarse grained particles have nearly plane sides but have well rounded corners and edges.
Rounded	Coarse grained particles have smoothly curved sides and no edges.

Soil Moisture Modifiers

Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

Soil Structure

Stratified	Alternating layers of varying material or color at least 6mm thick; note thickness and inclination.
Laminated	Alternating layers of varying material or color less than 6mm thick; note thickness and inclination.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, somtimes striated.
Blocky	Cohesive soil that can be broken down into smaller angular lumps which resist further breakdown.
Disrupted	Soil structure is broken and mixed. Infers that material has moved substantially - landslide debris.
Homogeneous	Same color and appearance throughout.

HCL Reaction

No HCL Reaction	No visible reaction.
Weak HCL Reaction	Some reaction with bubbles forming slowly.
Strong HCL Reaction	Violent reaction with bubbles forming imediately.

Degree of Vesicularity of Pyroclastic Rocks

Slightly Vesicular	5 to 10 percent of total
Moderately Vesicular	10 to 25 percent of total
Highly Vesicular	25 to 50 percent of total
Scoriaceous	Greater than 50 percent of total

Washington State Department of Transportation

Test Boring Legend

Grain Size

Fine Grained	< 1mm	Few crystal boundaries/grains are distinguishable in the field or with hand lens.
Medium Grained	1mm to 5mm	Most crystal boundaries/grains are distinguishable with the aid of a hand lens.
Coarse Grained	> 5mm	Most crystal boundaries/grains are distinguishable with the naked eye.

Weathered State

Term	Description	Grade
Fresh	No visible sign of rock material weathering; perhaps slight discoloration in major discontinuity surfaces.	I
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than its fresh condition.	II
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a continuous framework or as core stones.	III
Highly Weathered	More than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as discontinuous framework or as core stone.	IV
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	V
Residual Soil	All rock material is converted to soil. The mass structure and material fabric is destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI

Relative Rock Strength

Grade	Description	Field Identification	Uniaxial Compressive Strength approx
R1	Very Weak	Specimen crumbles under sharp blow from point of geological hammer, and can be cut with a pocket knife.	1 to 25 MPa
R2	Moderately Weak	Shallow cuts or scrapes can be made in a specimen with a pocket knife. Geological hammer point indents deeply with firm blow.	25 to 50 MPa
R3	Moderately Strong	Specimen cannot be scraped or cut with a pocket knife, shallow indentation can be made under firm blows from a hammer.	50 to 100 MPa
R4	Strong	Specimen breaks with one firm blow from the hammer end of a geological hammer.	100 to 200 MPa
R5	Very Strong	Specimen requires many blows of a geological hammer to break intact sample.	Greater than 200 MPa

Discontinuities

Spacing	
Very Widely	Greater than 3 m
Widely	1 m to 3 m
Moderately	0.3 m to 1 m
Closely	50 mm to 300 mm
Very Closely	Less than 50 mm

RQD (%)

$$\frac{100(\text{length of core in pieces} > 100\text{mm})}{\text{Length of core run}}$$

Condition	
Excellent	Very rough surfaces, no separation, hard discontinuity wall
Good	Slightly rough surfaces, separation less than 1 mm, hard discontinuity wall.
Fair	Slightly rough surfaces, separation greater than 1 mm, soft discontinuity wall.
Poor	Slickensided surfaces, or soft gouge less than 5 mm thick, or open discontinuities 1 to 5 mm.
Very Poor	Soft gouge greater than 5 mm thick, or open discontinuities greater than 5 mm.

Fracture Frequency (FF) is the average number of fractures per 300 mm of core.
Does not include mechanical breaks caused by drilling or handling.

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-1-04

Job No. XL-2201 SR 395 Elevation 1838.2 ft (560.3 m)

Sheet 1 of 4

Project NSLAC - Shady Slope Structures

Driller Vince Johnson Lic# 2532

Site Address Vic of US 2 & Shady Slope Rd.

Inspector Joe Judd

Start December 17, 2004 Completion December 18, 2004 Well ID#

Equipment CME 850 w/ autohammer

Station SS 18+08.49 Offset 2.29' Lt. Casing HQ

Method Wet Rotary

Northing 629817.8065 Easting 2819179.7789 Latitude

Longitude

County Spokane Subsection SW1/4,SE1/4 Section 4 Range 43EWM Township 26

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			4 4 4 (8)		D-1		Poorly graded SAND with silt and gravel, loose, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.8 ft, Length Retained 0.8 ft		
10	3			2 2 3 (5)		D-2		Poorly graded SAND with silt, loose, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.6 ft, Length Retained 0.6 ft		
	4			2 3 3 (6)		D-3	GS MC	SP-SM, M.C. = 19% Poorly graded SAND with silt, loose, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.6 ft, Length Retained 0.6 ft		
15	5			3 3 5 (8)		D-4		Poorly graded SAND with silt, loose, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.5 ft, Length Retained 0.5 ft		
			>>	60 (60)		D-5		Poorly graded SAND with silt, Olive Brown, moist, Homogeneous, HCl not tested, encounter gravel layer at approx. 16.5'. Driving on boulder. Drilled through boulder 17.5' to 18.5'. Length Recovered 0.3 ft, Length Retained 0.3 ft		
20	6			5 7		D-6		Silty SAND, medium dense, Olive Brown, moist, Homogeneous, HCl reaction not tested.		

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,3:07:38 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-1-04

Job No. XL-2201 SR 395 Elevation 1838.2 ft (560.3 m)

Sheet 2 of 4

Project NSLAC - Shady Slope Structures Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				6 (13)				Length Recovered 0.8 ft, Length Retained 0.8 ft		
				3 6 9 (15)		D-7		Silty SAND, medium dense, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.7 ft, Length Retained 0.7 ft		
25	7 8			8 8 8 (16)		D-8	GS MC	SM, M.C. = 25% Silty SAND, medium dense, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft, Length Retained 1.0 ft		
				3 5 5 (10)		D-9		Silty SAND, loose, Olive Brown, wet, Stratified, HCl reaction not tested, Silty SAND 27.0'-27.6', Olive Brown. Poorly graded SAND 27.6'-28.5', Dark Gray. Length Recovered 1.0 ft, Length Retained 0.9 ft		
30	9			3 3 11 (14)		D-10	GS MC AL	CH, M.C. = 37%, PI = 33 Fat CLAY,, medium dense, Dark Gray, moist, Stratified, HCl reaction not tested, 29.0' to 30.3' CLAY Dark Gray. 30.3' to 30.5' silty SAND Olive Brown. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	10			6 10 10 (20)		D-11		Silty SAND, medium dense, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.9 ft, Length Retained 0.9 ft		
35	11			8 10 11 (21)		D-12	GS MC	SM, M.C. = 20% Silty SAND, medium dense, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.3 ft, Length Retained 0.3 ft		
				6 9 10 (19)		D-13		Silty SAND, medium dense, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.8 ft, Length Retained 0.8 ft		
40	12 13			8 10 10 (20)		D-14		Silty SAND, medium dense, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft, Length Retained 1.0 ft		
45				8 8		D-15	GS MC	ML, M.C. = 27% Sandy SILT, medium dense, Olive Brown, moist,		

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,3:11:43 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-1-04

Job No. XL-2201 SR 395 Elevation 1838.2 ft (560.3 m)

Sheet 3 of 4

Project NSLAC - Shady Slope Structures

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				8 (16)				Homogeneous, HCl reaction not tested. Length Recovered 1.2 ft, Length Retained 1.2 ft		
	14									
	15			2 4 6 (10)		D-16		SILT, loose, Greenish Gray, moist, Stratified, HCl reaction not tested, 49.0 to 50.2 Silt. 50.2 to 50.5 Poorly Graded SAND. Length Recovered 1.5 ft, Length Retained 1.5 ft		
50										
	16									
				6 5 6 (11)		D-17		SILT with sand, medium dense, Gray, wet, Stratified, HCl reaction not tested. Length Recovered 0.3 ft, Length Retained 0.3 ft		
55										
	17									
	18			5 6 9 (15)		D-18	GS MC	ML, M.C. = 29% SILT with sand, medium dense, Gray, wet, Stratified, HCl reaction not tested. Length Recovered 1.4 ft, Length Retained 1.4 ft		
60										
	19									
				13 17 17 (34)		D-19		Well graded SAND, dense, Olive Brown, moist, Homogeneous, HCl reaction not tested, Material changed at 63.6 to gravel as indicated by drilling. Some Gravel at top of sample. Length Recovered 1.0 ft, Length Retained 1.0 ft		
65										
	20									
	21			17 18		D-20		Well graded SAND with gravel, dense, Olive Brown, moist, Homogeneous, HCl reaction not tested.		
70										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05 3:07:39 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-1-04

Job No. XL-2201 SR 395 Elevation 1838.2 ft (560.3 m)

Sheet 4 of 4

Project NSLAC - Shady Slope Structures Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				19 (37)				Length Recovered 1.2 ft, Length Retained 1.0 ft		
	22									
75	23			17 17 19 (36)		D-21		Well graded SAND, dense, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.1 ft, Length Retained 1.1 ft		
									12/17/2004 12/18/2004	
	24			16 18 19 (37)		D-22		Well graded SAND with gravel, dense, Olive Brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.2 ft, Length Retained 1.2 ft		
80										
	25							End of test hole boring at 80.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
								Bailed hole from 7.2 feet to 78.0 feet night of 12/17/04. A.M. of 12/18/04 water table was at 78.5 feet.		
85	26									
	27									
90										
	28									
95										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,3:07:39 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-2-04

Sheet 1 of 4

Job No. XL-2201 SR 395 Elevation 1839.2 ft (560.6 m)

Project NSLAC - Shady Slope Structures Driller Vince Johnson Lic# 2532

Site Address Vic of US 2 & Shady Slope Rd. Inspector Joe Judd

Start December 14, 2004 Completion December 15, 2004 Well ID# Equipment CME 850 w/ autohammer

Station SS 19+35.06 Offset 0.52' Lt. Casing 3.0 Method Wet Rotary

Northing 629925.081 Easting 2819111.0883 Latitude Longitude

County Spokane Subsection SW 1/4 SE 1/4 Section 4 Range 43 EWM Township 26

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				3 4 6 (10)		D-1		Silty SAND, loose, dark brown, moist, Homogeneous, no HCl reaction. Sub grade ended at 1.0 Length Recovered 0.8 ft, Length Retained 0.8 ft		
				3 5 5 (10)		D-2		Well graded SAND with silt, loose, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
				3 4 5 (9)		D-3		Well graded SAND with silt, loose, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft, Length Retained 0.8 ft		
				2 4 7 (11)		D-4		Well graded SAND with silt, medium dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.9 ft, Length Retained 0.9 ft		
				4 5 6 (11)		D-5		Well graded SAND with silt, medium dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft, Length Retained 0.8 ft		
				5 5 7 (12)		D-6	GS MC	SW-SM, M.C. = 19% Well graded SAND with silt, medium dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.7 ft, Length Retained 0.7 ft		
				4 5		D-7		Well graded SAND with silt, medium dense, brown, moist, Homogeneous, no HCl reaction. At 21.0 drilled .6		

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,8:56:43 A4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-2-04

Job No. XL-2201 SR 395 Elevation 1839.2 ft (560.6 m)

Sheet 2 of 4

Project NSLAC - Shady Slope Structures

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				10 (15)				layer of gravel Length Recovered 0.7 ft, Length Retained 0.7 ft		
				3 5 14 (19)		D-8		Sandy SILT, medium dense, olive gray, moist, Stratified, no HCl reaction. From 22.0 to 23.0 silt from 23.0 to 23.3 poorly graded sand Length Recovered 1.2 ft, Length Retained 1.2 ft		
25	7			6 8 10 (18)		D-9	GS MC	ML, M.C. = 26% Sandy SILT, medium dense, olive gray, moist, Homogeneous, no HCl reaction. Rust stains throughout sample Length Recovered 1.1 ft, Length Retained 1.1 ft		
	8			7 7 8 (15)		D-10		Sandy SILT, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Rust stains throughout sample Length Recovered 1.2 ft, Length Retained 1.2 ft		
30	9			3 4 6 (10)		D-11	GS MC	SM, M.C. = 25% Silty SAND, loose, dark gray, wet, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	10			10 15 18 (33)		D-12		Silty SAND, dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.7 ft, Length Retained 0.7 ft		
35	11									
	12			9 13 14 (27)		D-13	GS MC	SM, M.C. = 16% Silty SAND, dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.6 ft, Length Retained 0.6 ft		
40	13									
				6 10		D-14		Well graded SAND, medium dense, dark grayish brown, moist, Homogeneous, no HCl reaction.		
45										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,8:56:43 A4

Washington State Department of Transportation

LOG OF TEST BORING

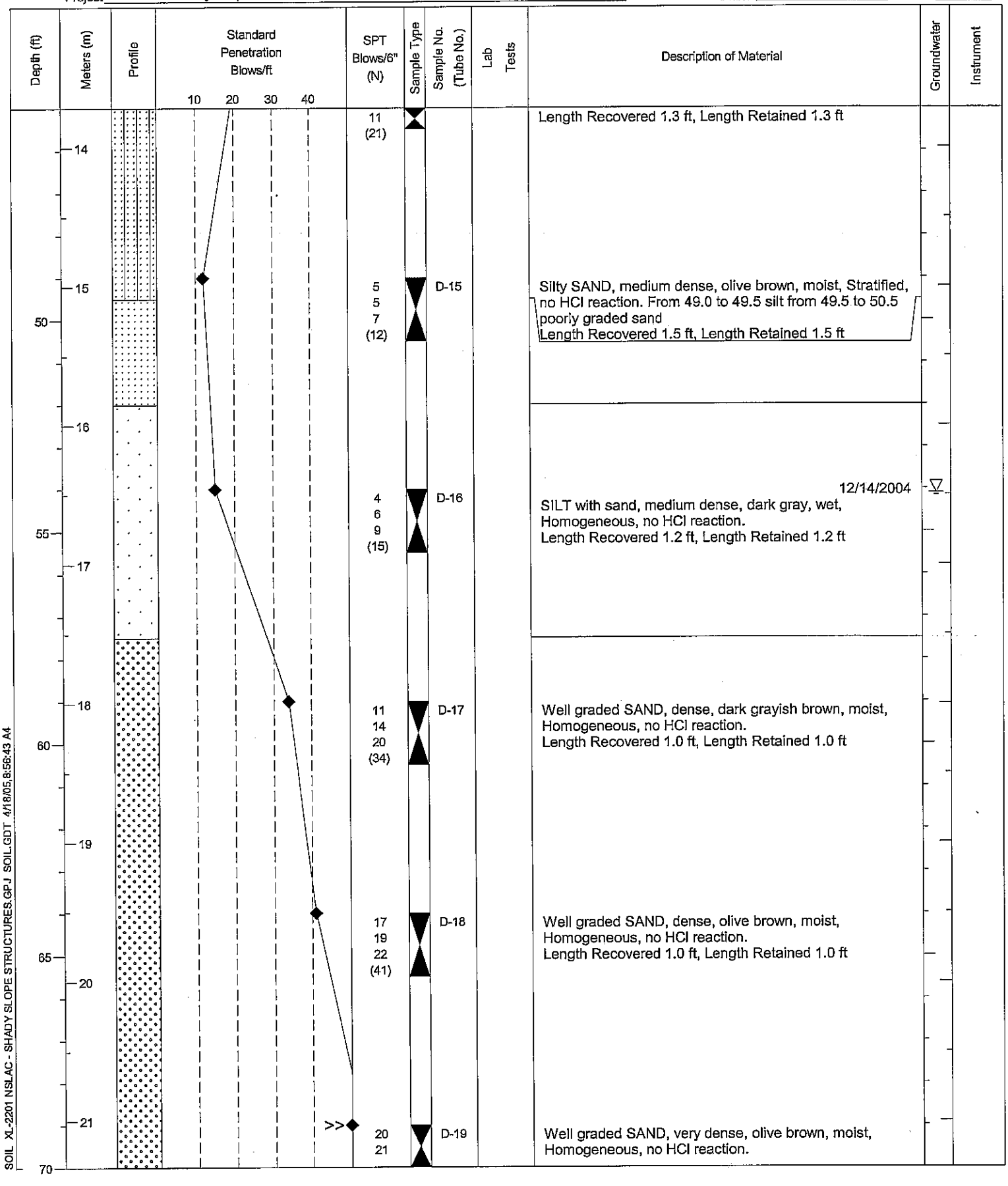
Start Card S-23734

HOLE No. SS-2-04

Job No. XL-2201 SR 395 Elevation 1839.2 ft (560.6 m)

Sheet 3 of 4

Project NSLAC - Shady Slope Structures Driller Vince Johnson Lic# 2532



SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,8:56:43 A4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-2-04

Job No. XL-2201 SR 395 Elevation 1839.2 ft (560.6 m)

Sheet 4 of 4

Project NSLAC - Shady Slope Structures Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				32 (53)				Length Recovered 1.1 ft, Length Retained 1.1 ft		
	22									
			>>	15 22 30 (52)		D-20		Well graded SAND, very dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.9 ft, Length Retained 0.9 ft		
75	23									
	24		>>	22 27 36 (63)		D-21		Well graded SAND with gravel, very dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
80										
	25							End of test hole boring at 80.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. BAILED hole from 15.0 to 54.1 wait 15 min. no Recharge.		
85	26									
	27									
90										
	28									
95										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,8:56:43 A4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65943

HOLE No. SS-3-04

Sheet 1 of 4

Job No. XL-2201 SR 395 Elevation 1837.2 ft (560.0 m)

Project NSLAC - Shady Slope Structures Driller Vince Johnson Lic# 2532

Site Address Vic of US 2 & Shady Slope Rd. Inspector Joe Judd

Start December 15, 2004 Completion December 16, 2004 Well ID# AHN 703 Equipment CME 850 w/ autohammer

Station SS 20+84.63 Offset 4.14' Lt. Casing 4.5 Method Wet Rotary

Northing 630055.7847 Easting 2819039.4893 Latitude Longitude

County Spokane Subsection SW 1/4 SE1/4 Section 4 Range 43 EWM Township 26

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				5 7 6 (13)		D-1		Poorly graded SAND, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft, Length Retained 0.8 ft		
				2 3 4 (7)		D-2		Poorly graded SAND with gravel, loose, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.9 ft, Length Retained 0.9 ft		
				3 3 5 (8)		D-3		Poorly graded SAND, loose, olive brown, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
				3 3 5 (8)		D-4	GS MC	SP, M.C. = 19% Poorly graded SAND, loose, olive brown, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
				4 4 6 (10)		D-5		Poorly graded SAND, loose, olive brown, moist, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft 12/16/2004	▽	
				5 4		D-6	GS MC	CH, M.C. = 44%, PI = 39 Fat CLAY, loose, light olive brown, moist, Stratified, no		

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,3:09:29 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65943

HOLE No. SS-3-04

Job No. XL-2201 SR 395 Elevation 1837.2 ft (560.0 m)

Sheet 2 of 4

Project NSLAC - Shady Slope Structures

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				5 (9)			AL	HCl reaction, SILT from 19.0 - 19.9 well graded SAND 19.9 - 20.3 Length Recovered 1.2 ft, Length Retained 1.2 ft		
				5 7 8 (15)		D-7		Silty SAND, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
25	7			6 6 8 (14)		D-8	GS MC	SM, M.C. = 28% Silty SAND, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.1 ft, Length Retained 1.1 ft		
	8			4 5 8 (13)		D-9	GS MC	ML, M.C. = 30% Sandy SILT , medium dense, dark gray, wet, Stratified, no HCl reaction, color change at 27.4. Length Recovered 1.3 ft, Length Retained 1.3 ft		
30	9			3 3 6 (9)		D-10	GS MC AL	CH, M.C. = 42%, PI = 38 Fat CLAY, stiff, dark gray, moist, Laminated, no HCl reaction. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	10					U-11 A B C		Sandy Lean CLAY, stiff, olive brown, moist, Stratified, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
35	11			11 9 13 (22)		D-12		Silty SAND, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.6 ft, Length Retained 0.6 ft		
				8 10 11 (21)		D-13	GS MC	SM, M.C. = 26% Silty SAND, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.7 ft, Length Retained 0.7 ft		
40	12			6 10 11 (21)		D-14		Silty SAND, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	13			3 5		D-15	GS MC	CH, M.C. = 41%, PI = 48 Fat CLAY, medium dense, gray, moist, Stratified, no HCl		
45										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05 3:09:30 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65943

HOLE No. SS-3-04

Job No. XL-2201 SR 395 Elevation 1837.2 ft (560.0 m)

Sheet 3 of 4

Project NSLAC - Shady Slope Structures Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				6 (11)			AL	reaction, from 44.0 - 45.4 CLAY from 45.4 - 45.5 well graded SAND Length Recovered 1.0 ft, Length Retained 1.0 ft		
	14									
	15			14 18 20 (38)		D-16		Well graded SAND with gravel, dense, olive brown, moist, Stratified, no HCl reaction. Length Recovered 0.5 ft, Length Retained 0.5 ft		
50										
	16									
				22 26 20 (46)		D-17		Well graded SAND, dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.6 ft, Length Retained 0.6 ft		
55										
	17									
	18		>>	23 42 50 (92)		D-18		Well graded SAND, very dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft, Length Retained 0.8 ft		
60										
	19									
			>>	237 35 32 (67)		D-19		Well graded SAND, very dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.6 ft, Length Retained 0.6 ft		
65										
	20									
	21		>>	20 37		D-20		Well graded SAND, very dense, olive brown, moist, Homogeneous, no HCl reaction.		
70										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05 3:09:30 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-65943

HOLE No. SS-3-04

Job No. XL-2201 SR 395 Elevation 1837.2 ft (560.0 m)

Sheet 4 of 4

Project NSLAC - Shady Slope Structures

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				49 (86)				Length Recovered 0.6 ft, Length Retained 0.6 ft		
	22							End of test hole boring at 70.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
								Bail Hole from 12.2 ft. to 40.5 ft. 1/2 hour recharge time, water at 34.5 ft.		
75	23									
	24									
80										
	25									
85	26									
	27									
90										
	28									
	95									

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,3:09:30 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-4-04

Sheet 1 of 5

Job No. XL-2201 SR 395 Elevation 1862.8 ft (567.8 m)

Project NSLAC - Shady Slope Structures Driller Sean Verlo Lic# 2615

Site Address Vic of US 2 & Shady Slope Rd. Inspector Dave Nelson

Start December 16, 2004 Completion December 17, 2004 Well ID# Equipment CME 45 w/ autohammer

Station SS 22+35.33 Offset 34.58' Rt Casing HQ x 100.0 Method Wet Rotary

Northing 630207.8695 Easting 2819038.3412 Latitude Longitude

County Spokane Subsection SW 1/4 of SE 1/4 Section 4 Range 43 EWM Township 26

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			4 6 5 (11)		D-1		Well graded SAND with silt, medium dense, brown, dry, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
10	3			5 6 6 (12)		D-2		Well graded SAND with silt, medium dense, brown, dry, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
15	5			4 4 4 (8)		D-3		Well graded SAND with silt, loose, brown, dry, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
20	6									

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,11:46:51 A4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-4-04

Job No. XL-2201 SR 395 Elevation 1862.8 ft (567.8 m)

Sheet 2 of 5

Project NSLAC - Shady Slope Structures Driller Sean Verlo Lic# 2615

Depth (ft)	Meters (m)	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			4 4 5 (9)		D-4		Well graded SAND with silt, loose, brown, dry, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
25	7		4 5 6 (11)		D-5	GS MC	SW-SM, M.C. = 20% Well graded SAND with silt, medium dense, brown, moist, Homogeneous, HCl reaction not tested Length Recovered 1.0 ft		
30	9		4 5 7 (12)		D-6		Well graded SAND with silt, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
35	11		6 8 9 (17)		D-7	GS MC	SW-SM, M.C. = 18% Well graded SAND with silt, medium dense, brown, moist, Homogeneous, HCl reaction not tested Length Recovered 1.0 ft		
40	12		6 9 9 (18)		D-8		Well graded SAND with silt, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	13		5 5 6 (11)		D-9		Well graded SAND, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
45									

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,11:46:51 A4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-4-04

Job No. XL-2201 SR 395 Elevation 1862.8 ft (567.8 m)

Sheet 3 of 5

Project NSLAC - Shady Slope Structures Driller Sean Verlo Lic# 2615

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			6 8 10 (18)		D-10		Well graded SAND, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
				6 10 12 (22)		D-11		Well graded SAND, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	15									
50				11 10 6 (16)		D-12	GS MC AL	CH, MC. = 38%, PI = 37 Fat CLAY, very stiff, brown, wet, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft	▽	
	16			6 8 8 (16)		D-13		Fat CLAY, very stiff, brown, wet, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
55				8 10 12 (22)		D-14		Silty SAND, medium dense, brown, moist, Laminated,Fissured, HCl reaction not tested. Length Recovered 1.0 ft		
	17									
				8 11 14 (25)		D-15	GS MC	SM, M.C. = 25% Silty SAND, dense, brown, moist, Laminated,Fissured, HCl reaction not tested. Length Recovered 1.0 ft		
	18									
60						U-16 A B C D E		Silty SAND, dense, grey, moist, Laminated,Fissured,Homogeneous, HCl reaction not tested. Length Recovered 1.3 ft		
	19			6 17 19 (36)		D-17		Silty SAND, dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
65				9 9 10 (19)		D-18	GS MC	SM, M.C. = 24% Silty SAND, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	20									
				9 11 11 (22)		D-19		Silty SAND, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	21									
70										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,11:46:51 A4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-4-04

Job No. XL-2201 SR 395 Elevation 1862.8 ft (567.8 m)

Sheet 4 of 5

Project NSLAC - Shady Slope Structures Driller Sean Verlo Lic# 2615

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				9 13 15 (28)		D-20		Silty SAND, dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	22			10 14 16 (30)		D-21		Silty SAND, dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
75	23			14 18 22 (40)		D-22	GS MC	SM, M.C. = 13% Silty SAND, dense, brown, moist, Homogeneous, HCl reaction not tested Length Recovered 1.0 ft		
	24									
80				18 22 26 (48)		D-23		Silty SAND, dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	25									
85	26		>>	18 25 30 (55)		D-24		Silty SAND, dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	27									
90			>>	23 34 38 (72)		D-25	GS MC	SM, M.C. = 10% Silty SAND, very dense, brown, moist, Homogeneous, HCl reaction not tested Length Recovered 1.0 ft		
	28									
95			>>							

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,11:46:52 A4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-4-04

Job No. XL-2201 SR 395 Elevation 1862.8 ft (567.8 m)

Sheet 5 of 5

Project NSLAC - Shady Slope Structures Driller Sean Verlo Lic#. 2615

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29		>>	21 25 27 (52)		D-26		Silty SAND, very dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	30									
100			>>	24 36 40 (76)		D-27		Silty SAND with gravel, very dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	31							End of test hole boring at 101.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
105	32									
	33									
110	34									
	35									
115	36									
120										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,11:46:52 A4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-5-04

Job No. XL-2201 SR 395 Elevation 1859.3 ft (566.7 m)

Sheet 1 of 4

Project NSLAC - Shady Slope Structures

Driller Sean Verlo Lic# 2615

Site Address Vic of US 2 & Shady Slope Rd.

Inspector Dave Nelson

Start December 14, 2004 Completion December 15, 2004 Well ID#

Equipment CME 45 w/ autohammer

Station SS 24+90.65 Offset 0.23' Lt. Casing HQ x 88.0

Method Wet Rotary

Northing 630456.3851 Easting 2819010.8388 Latitude

Longitude

County Spokane Subsection SW 1/4 of SE 1/4 Section 4 Range 43 EWM Township 26

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 3 4 (7)		D-1		Poorly graded SAND with silt, loose, brown, dry, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
5	1									
	2			3 4 4 (8)		D-2		Poorly graded SAND with silt, loose, brown, dry, Homogeneous, no HCl reaction. Length Recovered 1.0 ft		
10	3									
	4			4 5 7 (12)		D-3	GS MC	SP-SM, M.C. = 23% Poorly graded SAND with silt, medium dense, brown, dry, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
15	5									
				3 4 7 (11)		D-4		Poorly graded SAND with silt, medium dense, brown, dry, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
20	6									

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05 12:01:14 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-5-04

Sheet 2 of 4

Job No. XL-2201 SR 395 Elevation 1859.3 ft (566.7 m)

Project NSLAC - Shady Slope Structures Driller Sean Verlo Lic# 2615

Depth (ft)	Meters (m)	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	7		4 4 7 (11)		D-5		Poorly graded SAND with silt, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
25	8								
			6 8 8 (16)		D-6		Poorly graded SAND with silt, medium dense, reddish brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	9								
30									
	10		4 5 8 (13)		D-7		Poorly graded SAND with silt, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
35									
	11								
			5 6 7 (13)		D-8	GS MC	SP-SM, M.C. = 20% Poorly graded SAND with silt, medium dense, brown, moist, Homogeneous, HCl reaction not tested Length Recovered 1.0 ft		
	12								
40									
	13		10 9 8 (17)		D-9		Poorly graded SAND with silt AND gravel, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
45									

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05 12:01:15 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-5-04

Job No. XL-2201 SR 395 Elevation 1859.3 ft (566.7 m)

Sheet 3 of 4

Project NSLAC - Shady Slope Structures Driller Sean Verlo Lic# 2615

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14									
				5 8 10 (18)		D-10		Well graded SAND, medium dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
50	15								▽	
									12/15/2004	
	16			3 4 9 (13)		D-11	GS MC	ML, M.C. = 22% Sandy SILT, medium dense, brown/grey, wet, Stratified, HCl reaction not tested, stratified w/ silt. Length Recovered 1.5 ft		
55	17									
				9 12 15 (27)		D-12		Silty SAND with gravel, angular, dense, brown, wet, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	18									
60										
	19		>>	24 30 30 (60)		D-13		Silty SAND with gravel, very dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
65	20									
				15 15 21 (36)		D-14	GS MC	SM, M.C. = 14% Silty SAND, dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
	21									
70										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,12:01:15 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-5-04

Job No. XL-2201 SR 395 Elevation 1859.3 ft (566.7 m)

Sheet 4 of 4

Project NSLAC - Shady Slope Structures Driller Sean Verlo Lic# 2615

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22		>>	23 29 23 (52)		D-15		Silty SAND, very dense, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft		
75	23									
				8 9 16 (25)		D-16	GS MC	ML, M.C. = 33% SILT with sand, very stiff, brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.5 ft		
80	24									
	25									
				10 15 21 (36)		D-17	GS MC	ML, M.C. = 32% SILT with sand, mottled, dense, reddish brown, moist, Homogeneous, HCl reaction not tested Length Recovered 1.5 ft		
85	26									
	27			6 11 14 (25)		D-18		SILT with sand, mottled, medium dense, reddish brown, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.5 ft		
90								End of test hole boring at 89.5 ft below ground elevation.		
	28							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
95										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05 12:01:15 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-6-04

Sheet 1 of 3

Job No. XL-2201 SR 395 Elevation 1846.9 ft (562.9 m)

Project NSLAC - Shady Slope Structures Driller Vince Johnson Lic# 2532

Site Address Vic of US 2 & Shady Slope Rd. Inspector Joe Judd

Start December 16, 2004 Completion December 17, 2004 Well ID# Equipment CME 850 w/ autohammer

Station SS 26+51.97 Offset 7.82' Lt. Casing 3.0 Method Wet Rotary

Northing 630612.2254 Easting 2819055.3144 Latitude Longitude

County Spokane Subsection SW 1/4 SE 1/4 Section 4 Range 43 EWM Township 26

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				2 2 2 (4)		d-1		Silty SAND, very loose, dark brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.6 ft, Length Retained 0.6 ft		
	1									
				3 3 3 (6)		D-2		Silty SAND, loose, pale yellow, dry, Homogeneous, no HCl reaction. Length Recovered 0.7 ft, Length Retained 0.7 ft		
5										
	2									
				3 5 7 (12)		D-3	GS MC	SM, M.C. = 15% Silty SAND, medium dense, dark brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.9 ft, Length Retained 0.9 ft		
				12 10 12 (22)		D-4	GS MC	SM, M.C. = 14% Silty SAND, medium dense, olive brown, moist, Homogeneous, no HCl reaction, encountered gravels 11.5. Length Recovered 0.8 ft, Length Retained 0.8 ft 12/17/2004	▽	
10	3									
				35 26 21 (47)		D-5		Well graded GRAVEL with sand, cobbles, angular, dense, BLACK, moist, Homogeneous, no HCl reaction, driving on cobble. Length Recovered 0.1 ft, Length Retained 0.1 ft		
	4									
				5 6 6 (12)		D-6		Poorly graded SAND with silt and gravel, medium dense, olive brown, moist, Homogeneous, no HCl reaction, incountered cobble at 16.0. Length Recovered 0.6 ft, Length Retained 0.6 ft		
15										
	5									
				6 9 6 (15)		D-7	GS MC	SP-SM, M.C. = 16% Poorly graded SAND with silt, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.6 ft, Length Retained 0.6 ft		
				5 7		D-8		Silty SAND, medium dense, olive brown, moist, Stratified, no HCl reaction, from 19.0 to19.3 silt from 19.3 to 20.0		
20	6									

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05 1:02:40 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

HOLE No. SS-6-04

Job No. XL-2201 SR 395 Elevation 1846.9 ft (562.9 m)

Sheet 2 of 3

Project NSLAC - Shady Slope Structures

Driller Vince Johnson Lic# 2532

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				8 (15)				silty sand. Length Recovered 1.0 ft, Length Retained 1.0 ft		
				6 7 7 (14)		D-9	GS MC	SM, M.C. = 22% Silty SAND, medium dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.7 ft, Length Retained 0.7 ft		
25	7			5 6 4 (10)		D-10		Poorly graded SAND, loose, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft, Length Retained 0.8 ft		
	8			2 3 7 (10)		D-11	GS MC AL	CH, M.C. = 35%, PI = 31 Fat CLAY, stiff, grayish brown, moist, Laminated, no HCl reaction, attempted undisturbed at 29.0 able to push to 29.5 no recovery. Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	9			22 24 26 (50)		D-12	GS MC	SM, M.C. = 15% Silty SAND, dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	10		>>	16 25 31 (56)		D-13		Well graded SAND with gravel, very dense, olive brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.1 ft, Length Retained 1.1 ft		
35	11									
	12			14 17 18 (35)		D-14	GS MC AL	ML, M.C. = 30%, PI = 13 SILT with sand, dense, pale yellow, moist, Stratified, no HCl reaction, rust stains throughout sample. Length Recovered 1.3 ft, Length Retained 1.3 ft		
40	13									
45				13 13		D-15		Sandy SILT, dense, pale yellow, moist, Stratified, no HCl reaction, rust staining throughout sample.		

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/18/05,3:13:53 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23734

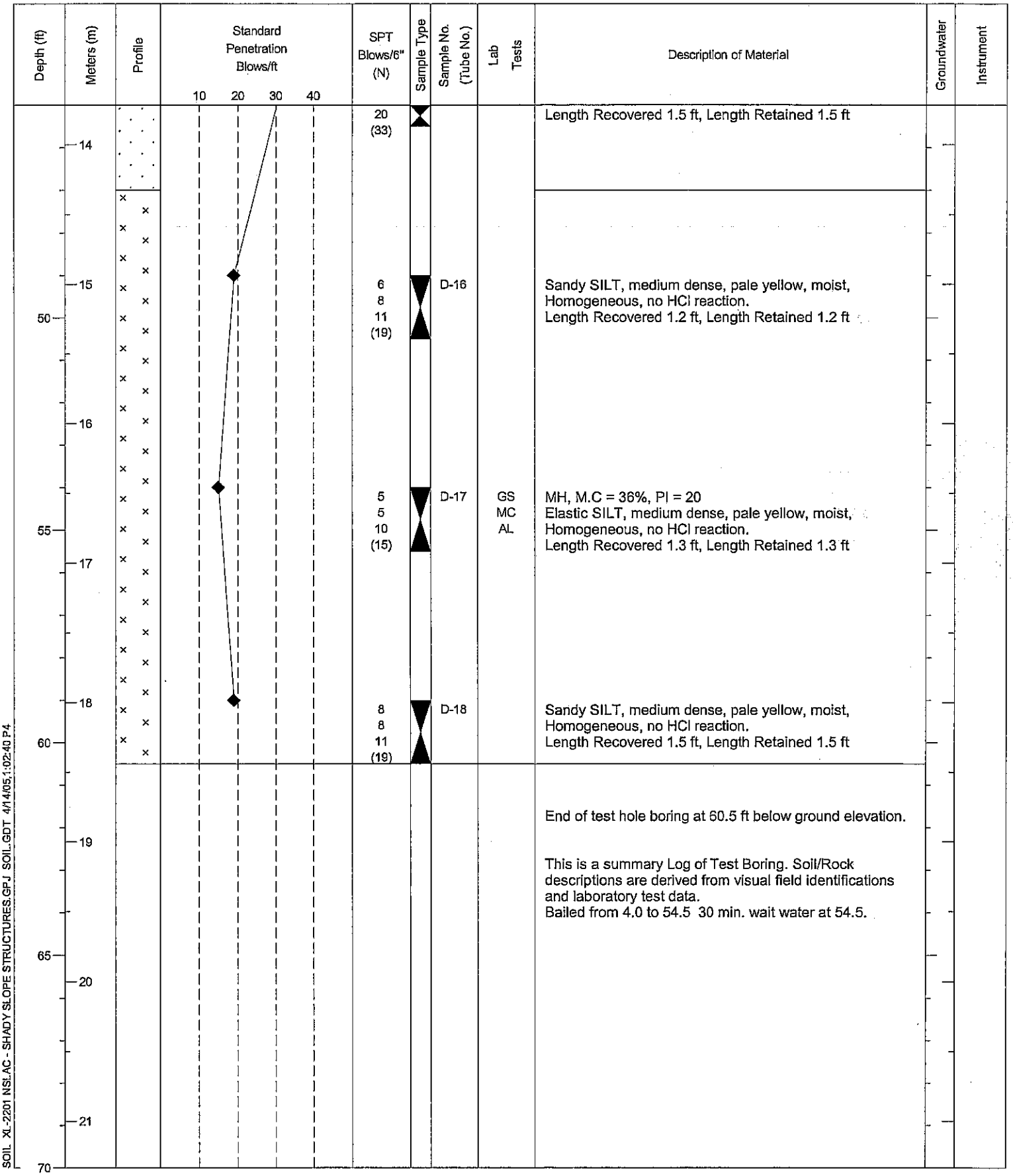
HOLE No. SS-6-04

Sheet 3 of 3

Job No. XL-2201 SR 395 Elevation 1846.9 ft (562.9 m)

Project NSLAC - Shady Slope Structures

Driller Vince Johnson Lic# 2532



Length Recovered 1.5 ft, Length Retained 1.5 ft

Sandy SILT, medium dense, pale yellow, moist, Homogeneous, no HCl reaction.
Length Recovered 1.2 ft, Length Retained 1.2 ft

MH, M.C = 36%, PI = 20
Elastic SILT, medium dense, pale yellow, moist, Homogeneous, no HCl reaction.
Length Recovered 1.3 ft, Length Retained 1.3 ft

Sandy SILT, medium dense, pale yellow, moist, Homogeneous, no HCl reaction.
Length Recovered 1.5 ft, Length Retained 1.5 ft

End of test hole boring at 60.5 ft below ground elevation.

This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.
Bailed from 4.0 to 54.5 30 min. wait water at 54.5.

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05 1:02:40 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23748

HOLE No. SS-7-05

Sheet 1 of 5

Job No. XL-2201 SR 395 Elevation 1874.8 ft (571.4 m)

Project NSLAC - Shady Slope Structures Driller Cooper Lic# 2552

Site Address US 2 vicinity of Shady Slope. Inspector Nebgen

Start March 8, 2005 Completion March 9, 2005 Well ID# Equipment CME 45 w/ autohammer

Station SS 23+11.466 Offset 15.133' Rt Casing 9x99 Method Wet Rotary

Northing 630278.9361 Easting 2819011.6471 Latitude Longitude

County Spokane Subsection SW/SE Section 4 Range 43EWM Township 26 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			1 4 5 (9)		D-1		Poorly graded SAND, fine, loose, brown, dry, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
10	2 3			2 4 4 (8)		D-2		Poorly graded SAND, fine, loose, brown, dry, Homogeneous, no HCl reaction. Length Recovered 1.1 ft, Length Retained 1.0 ft		
15	4 5			4 5 6 (11)		D-3		Poorly graded SAND, fine, medium dense, brown, dry, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
20	6			3 4		D-4		Poorly graded SAND, fine to medium, loose, brown, dry, Homogeneous, no HCl reaction.		

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05 1:37:47 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23748

HOLE No. SS-7-05

Job No. XL-2201 SR 395 Elevation 1874.8 ft (571.4 m)

Sheet 2 of 5

Project NSLAC - Shady Slope Structures Driller Cooper Lic# 2552

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				5 (9)				Length Recovered 1.0 ft, Length Retained 1.0 ft		
	7									
25				3 6 6 (12)		D-5		Poorly graded SAND, fine to medium, medium dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft, Length Retained 0.8 ft		
	8									
	9			3 4 5 (9)		D-6	GS MC	SP, M.C. = 22% Poorly graded SAND, fine to medium, loose, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
30										
	10									
				4 8 10 (18)		D-7		Poorly graded SAND, fine with one clay laminae., medium dense, brown, moist, Laminated, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
35	11									
	12			14 18 22 (40)		D-8		Poorly graded SAND with gravel, silty, dense, brown, moist, Laminated, no HCl reaction. Length Recovered 1.2 ft, Length Retained 1.0 ft		
40										
	13			7 15 27 (42)		D-9	GS MC	SP, M.C. = 19% Poorly graded SAND, dense, brown, moist, Laminated, no HCl reaction. ball of clay at 42.5' Length Recovered 1.3 ft, Length Retained 1.0 ft		
				5 10		D-10		Poorly graded SAND, medium dense, brown, moist, Homogeneous, no HCl reaction.		
45										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,1:37:48 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23748

HOLE No. SS-7-05

Job No. XL-2201 SR 395 Elevation 1874.8 ft (571.4 m)

Sheet 3 of 5

Project NSLAC - Shady Slope Structures Driller Cooper Lic# 2552

Depth (ft)	Meters (m)	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			11 (21)				Length Recovered 1.0 ft, Length Retained 1.0 ft		
	14		5 11 14 (25)		D-11		Poorly graded SAND, dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft, Length Retained 0.8 ft		
	15		6 10 12 (22)		D-12	GS MC	SP, M.C. = 14% Poorly graded SAND, medium dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.9 ft, Length Retained 0.9 ft		
50			6 10 11 (21)		D-13		Poorly graded SAND, coarse, medium dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.1 ft, Length Retained 1.1 ft		
	16		8 14 10 (24)		D-14		Poorly graded SAND, coarse with one gravel., medium dense, brown, moist, Laminated, no HCl reaction. Length Recovered 1.0 ft, Length Retained 1.0 ft		
55			10 8 12 (20)		D-15	GS MC	SP, M.C. = 17% Poorly graded SAND, medium dense, brown, moist, Laminated, no HCl reaction. stratified dense gravel 58 to 59 ft. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	17								
	18		8 10 8 (18)		D-16		Poorly graded SAND with gravel, medium dense, brown, moist, Stratified, no HCl reaction. Length Recovered 0.8 ft, Length Retained 0.8 ft		
60			7 9 10 (19)		D-17		Poorly graded SAND with gravel, medium dense, brown, moist, Stratified, no HCl reaction. Length Recovered 1.2 ft, Length Retained 1.0 ft		
	19								
			7 8 11 (19)		D18	GS MC	SM, M.C. = 30% Silty SAND, fine, medium dense, brown, moist, Laminated, no HCl reaction. thin rusty laminated at 64.1 ft. Length Recovered 1.0 ft, Length Retained 1.0 ft		
65	20		8 10 9 (19)		D-19		Silty SAND, fine, medium dense, brown and rusty brown, moist, Laminated, no HCl reaction. Length Recovered 0.5 ft, Length Retained 0.5 ft		
	21		4 5		D-20		Lean CLAY with sand, sand partings., stiff, brown to grey, moist, Laminated, no HCl reaction.		
70									

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05 1:37:48 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23748

HOLE No. SS-7-05

Job No. XL-2201 SR 395 Elevation 1874.8 ft (571.4 m)

Sheet 4 of 5

Project NSLAC - Shady Slope Structures Driller Cooper Lic# 2552

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				6 (11)				Length Recovered 1.5 ft, Length Retained 1.2 ft		
	22									
				1 2 3 (5)		D-21	GS MC AL	CL, M.C. = 37%, PI = 12 Lean CLAY, with laminae silt., medium stiff, grey, moist, Laminated, no HCl reaction. Length Recovered 1.5 ft, Length Retained 1.2 ft		
75	23					U-22		No Recovery		
	24			18 23 25 (48)		D-23	GS MC	SM, M.C. = 22% Silty SAND, fine, dense, brown, moist, Laminated, no HCl reaction. Length Recovered 1.5 ft, Length Retained 1.2 ft		
80	25									
			>>	25 40 43 (83)		D-24		Silty SAND, fine to medium, very dense, brown, moist, Laminated, no HCl reaction. Length Recovered 1.3 ft, Length Retained 1.1 ft		
85	26									
	27		>>	30 34 39 (73)		D-25	GS MC	SW-SM, M.C. = 15% Well graded SAND with silt, very dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.3 ft, Length Retained 1.2 ft		
90	28									
			>>	37 36		D-26		Well graded SAND with silt and gravel, very dense, brown, moist, Homogeneous, no HCl reaction.		
95										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,1:37:48 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-23748

HOLE No. SS-7-05

Sheet 5 of 5

Job No. XL-2201 SR 395 Elevation 1874.8 ft (571.4 m)

Project NSLAC - Shady Slope Structures Driller Cooper Lic# 2552

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29			50 (86)				Length Recovered 1.1 ft, Length Retained 1.0 ft		
	30									
				35 50 (50)		D-27		Well graded SAND with silt and gravel, very dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft, Length Retained 0.8 ft		
100										
	31							End of test hole boring at 100 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
								(DRY HOLE)		
105	32									
	33									
110										
	34									
	35									
115										
	36									
120										

SOIL XL-2201 NSLAC - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 4/14/05,1:37:48 P4

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-66010

HOLE No. SS-8-05

Sheet 1 of 1

Job No. XL-2201 SR 395 Elevation 1839.2 ft (560.6 m)

Project NSLAC - Shady Slope Structures Driller Kerry Cooper Lic# 2552

Site Address US-2 vic. of Shady Slope Inspector Don Nebgen

Start March 8, 2005 Completion March 8, 2005 Well ID# Equipment CME 45 w/ autohammer

Station SS 19+35.06 Offset 0.52' Lt. Casing 4" Method Auger

Northing 629925.081 Easting 2819111.088 Latitude Longitude

County Spokane Subsection SW 1/4 of SE 1/4 Section 4 Range 43 E Township 26 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								No Sample Taken See Boring SS-2-04 for soils information		
5	1									
	2									
10	3									
	4									
15	5									
	6							Piezometer dry @ time of installation [Abandoned 4/28/2005] - Dry		
20								End of test hole boring at 20 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		

SOIL XL-2201 NSLAG - SHADY SLOPE STRUCTURES.GPJ SOIL.GDT 7/11/05,11:04:15 A7

APPENDIX C

LABORATORY TESTING

LABORATORY TESTING

Laboratory testing was performed on selected samples from the field exploration program. Testing included performing moisture content, grain size analyses and Atterberg Limits. The tests were done in general accordance with AASHTO T-88, T-89, and T-90 guide specifications, respectively. After the testing was complete, the samples were classified in general accordance with the Unified Soil Classification System (USCS).

Job No. **XL-2201** Date **April 8, 2005**

Hole No. **SS-1-04** Sheet **1** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

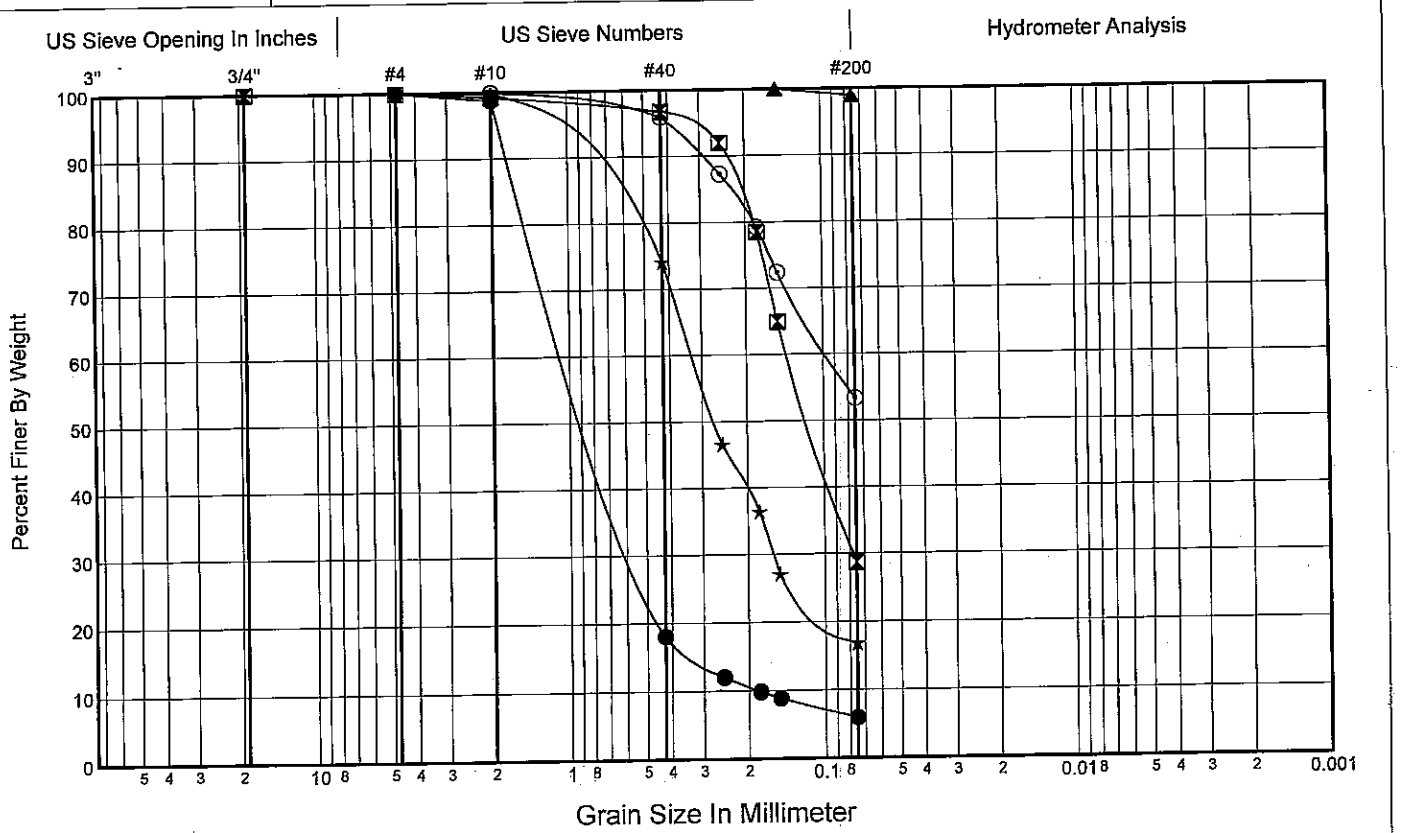
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	12.0	3.66	D-3	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	19			
⊠	24.0	7.32	D-8	SM	See Boring Log	SILTY SAND	25			
▲	29.0	8.84	D-10	CH	See Boring Log	FAT CLAY	37	63	30	33
★	34.0	10.36	D-12	SM	See Boring Log	SILTY SAND	20			
⊙	44.0	13.41	D-15	ML	See Boring Log	SANDY SILT	27			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	94.1	5.9	1.6	5.1
⊠	0.1	71.3	28.6		
▲	0.0	1.1	98.9		
★	0.0	83.2	16.8		
⊙	0.0	46.7	53.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.952	0.79	0.54	0.44	0.186
⊠	0.137	0.11	0.08		
▲					
★	0.324	0.27	0.16	0.09	
⊙	0.096				



Job No. **XL-2201** Date **April 8, 2005**

Hole No. **SS-1-04** Sheet **2** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

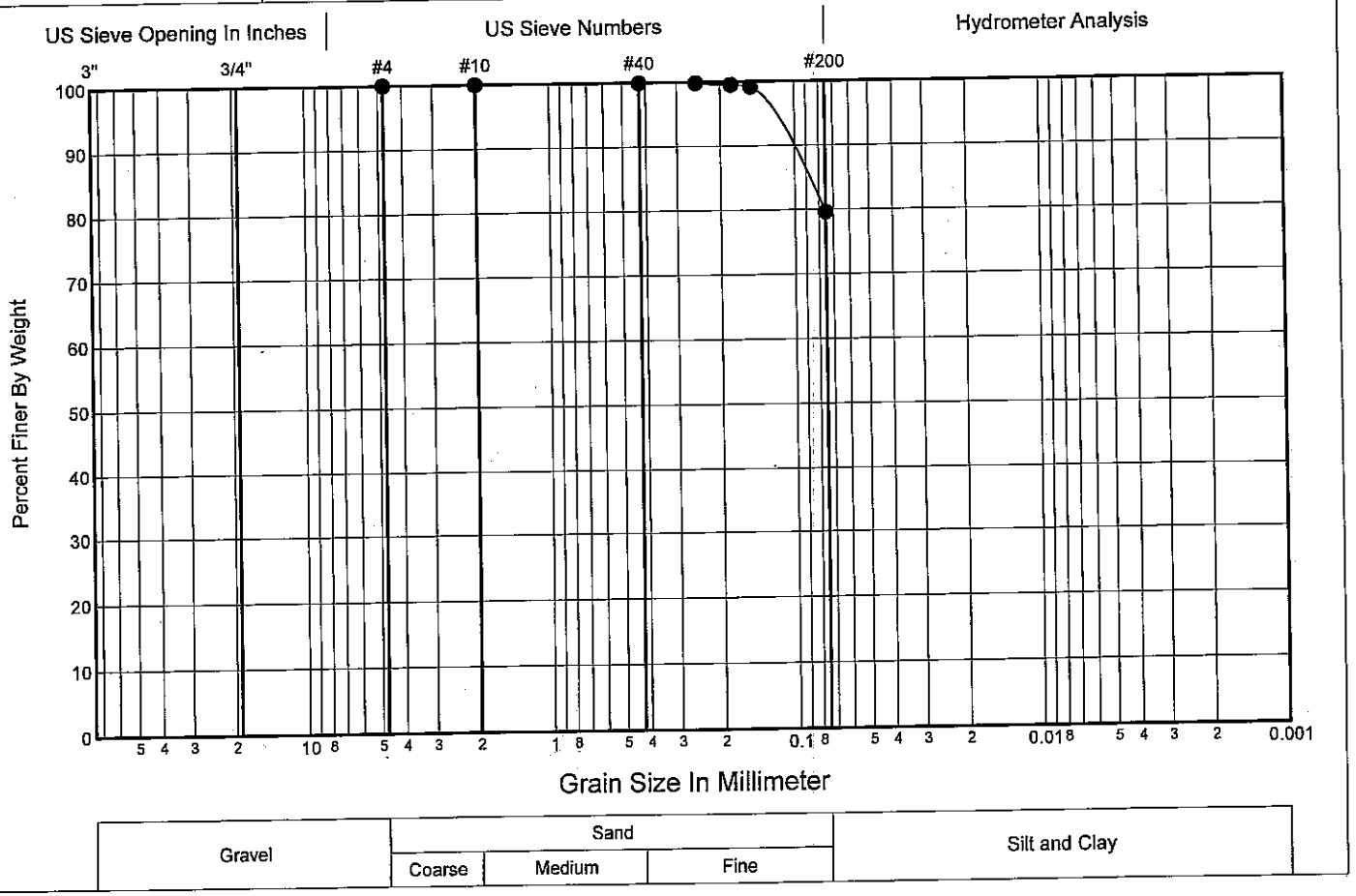
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	59.0	17.98	D-18	ML	See Boring Log	SILT with SAND	29			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	20.4	79.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					



Job No. **XL-2201** Date **March 28, 2005**

Hole No. **SS-2-04** Sheet **1** of **1**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

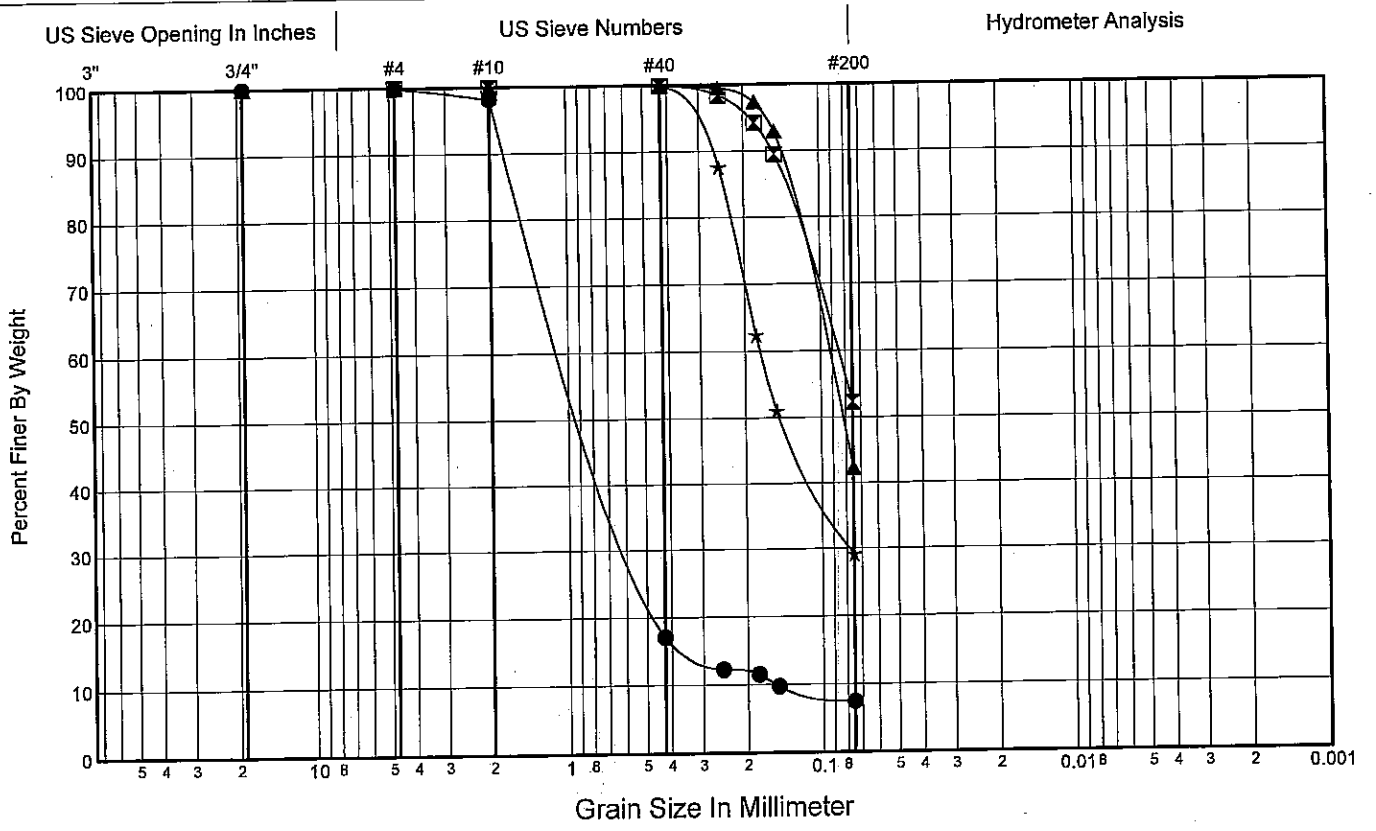
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	17.0	5.18	D-6	SW-SM	See Boring Log	WELL-GRADED SAND with SILT	19			
⊠	24.0	7.32	D-9	ML	See Boring Log	SANDY SILT	26			
▲	29.0	8.84	D-11	SM	See Boring Log	SILTY SAND	25			
★	39.0	11.89	D-13	SM	See Boring Log	SILTY SAND	16			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.1	92.5	7.4	2.0	6.2
⊠	0.0	47.7	52.3		
▲	0.1	57.7	42.2		
★	0.0	70.9	29.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.965	0.80	0.54	0.45	0.155
⊠	0.087				
▲	0.096	0.08			
★	0.173	0.15	0.08		



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **XL-2201** Date **April 8, 2005**

Hole No. **SS-3-04** Sheet **1** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

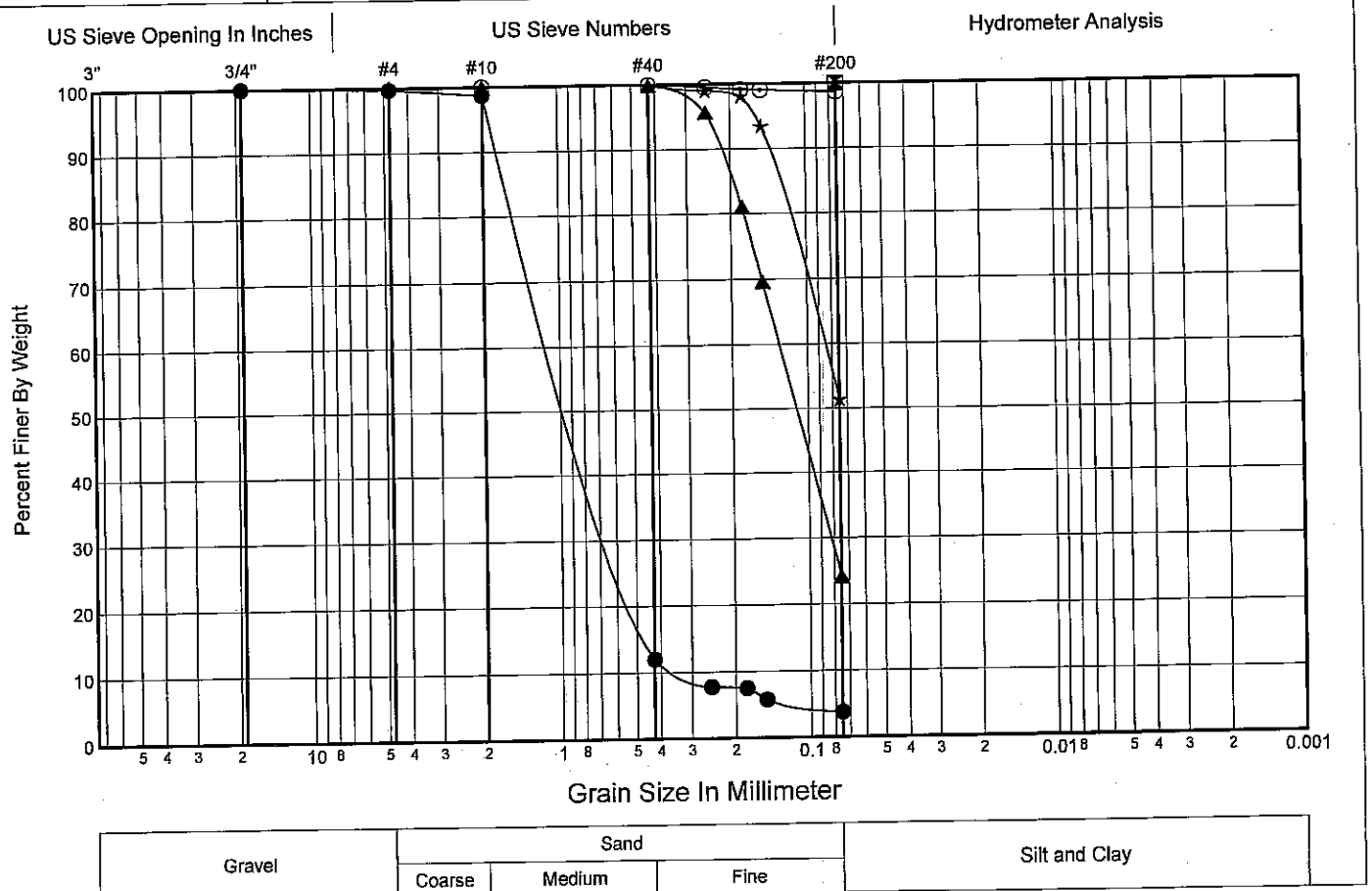
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	14.0	4.27	D-4	SP	See Boring Log	POORLY GRADED SAND	19			
⊠	19.0	5.79	D-6	CH	See Boring Log	FAT CLAY	44	70	31	39
▲	24.0	7.32	D-8	SM	See Boring Log	SILTY SAND	28			
★	27.0	8.23	D-9	ML	See Boring Log	SANDY SILT	30			
⊙	29.0	8.84	D-10	CH	See Boring Log	FAT CLAY	42	68	30	38

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.3	96.0	3.7	1.0	3.0
⊠	0.0	0.0	100.0		
▲	0.0	75.9	24.1		
★	0.0	48.7	51.3		
⊙	0.0	1.4	98.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	1.002	0.84	0.59	0.49	0.333
⊠					
▲	0.130	0.11	0.08		
★	0.086				
⊙					



Job No. **XL-2201** Date **April 8, 2005**

Hole No. **SS-3-04** Sheet **2** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

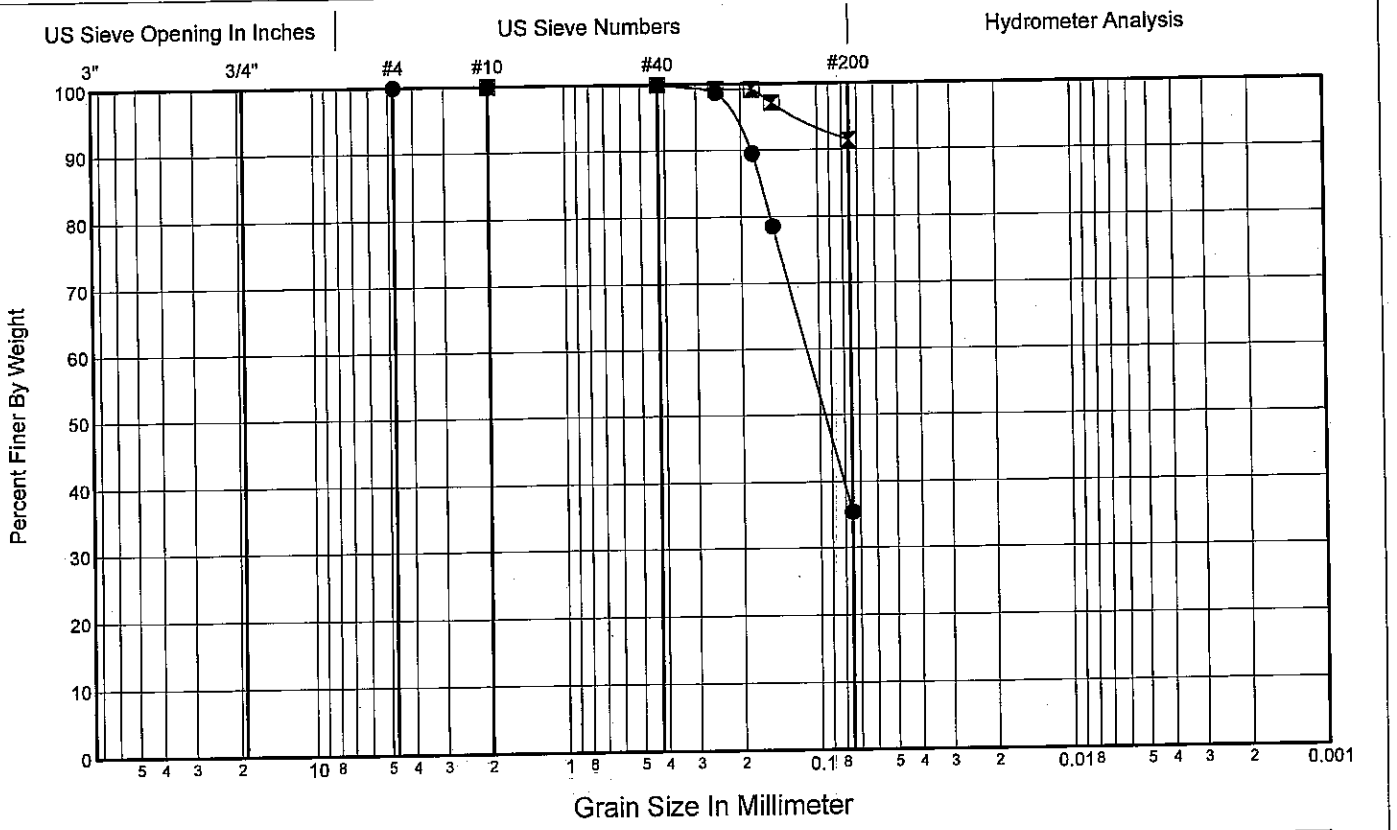
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	37.0	11.28	D-13	SM	See Boring Log	SILTY SAND	26			
⊠	44.0	13.41	D-15	CH	See Boring Log	FAT CLAY	41	83	35	48

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	64.6	35.4		
⊠	0.0	8.6	91.4		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.111	0.09			
⊠					



Job No. **XL-2201** Date **April 8, 2005**

Hole No. **SS-4-04** Sheet **1** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

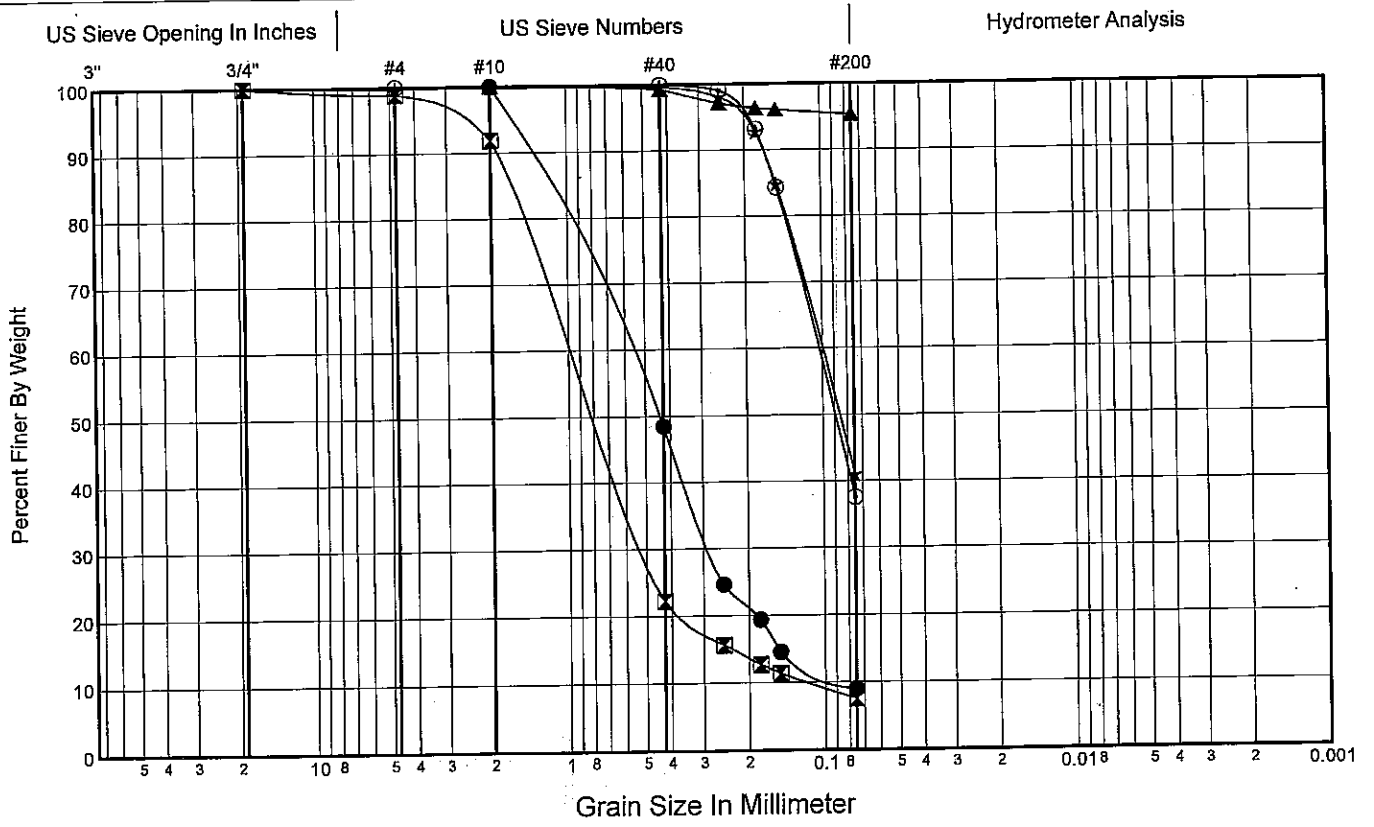
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	25.0	7.62	D-5	SW-SM	See Boring Log	WELL-GRADED SAND with SILT	20			
⊠	35.0	10.67	D-7	SW-SM	See Boring Log	WELL-GRADED SAND with SILT	18			
▲	50.0	15.24	D-12	CH	See Boring Log	FAT CLAY	38	68	31	37
★	57.5	17.53	D-15	SM	See Boring Log	SILTY SAND	25			
⊙	65.0	19.81	D-18	SM	See Boring Log	SILTY SAND	24			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	91.1	8.9	1.5	7.0
⊠	1.1	91.4	7.5	2.2	8.4
▲	0.0	4.7	95.3		
★	0.2	58.9	41.0		
⊙	0.0	62.5	37.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.602	0.45	0.28	0.19	0.086
⊠	0.985	0.79	0.51	0.36	0.117
▲					
★	0.101	0.09			
⊙	0.105	0.09			



Job No. **XL-2201** Date **April 8, 2005**

Hole No. **SS-4-04** Sheet **2** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

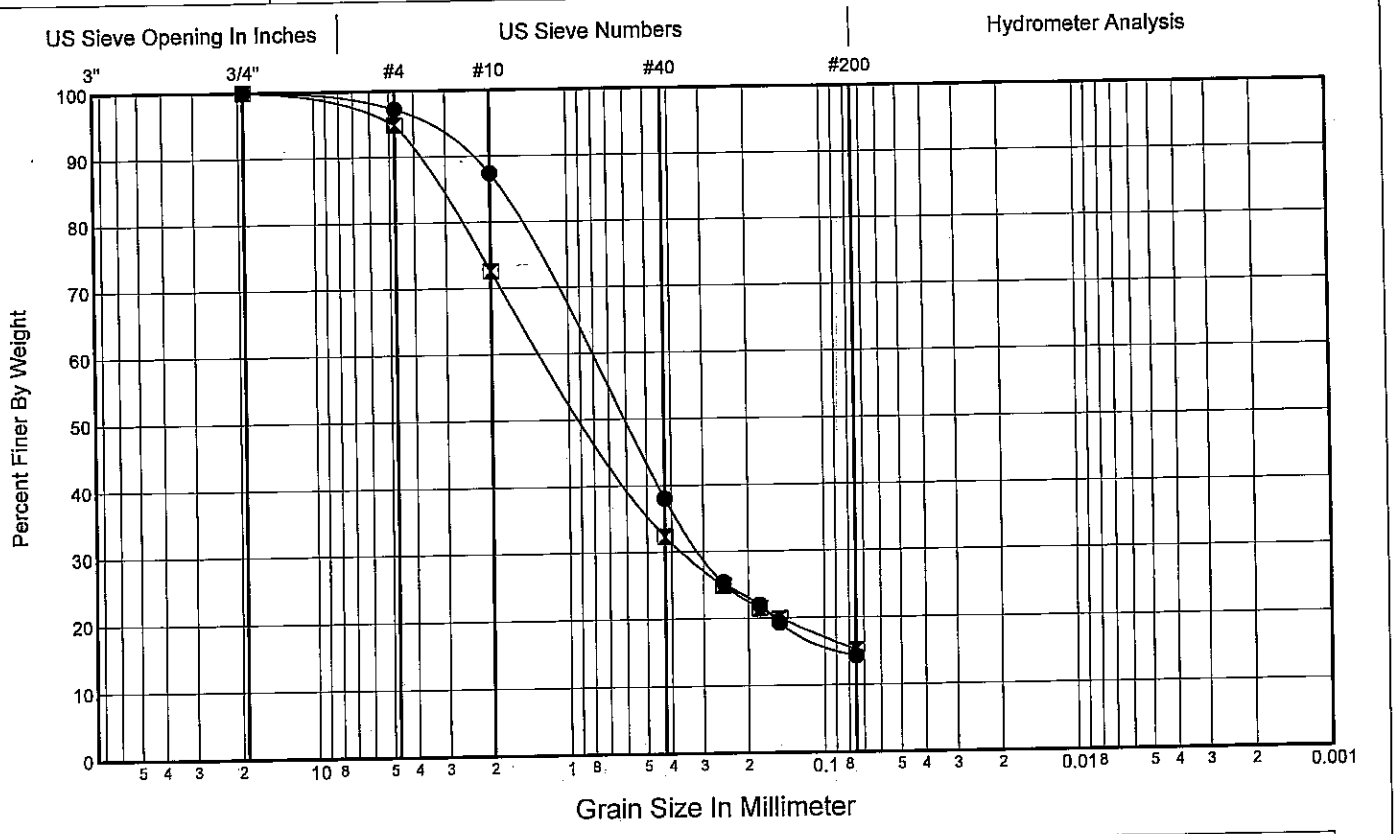
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	75.0	22.86	D-22	SM	See Boring Log	SILTY SAND	13			
⊠	90.0	27.43	D-25	SM	See Boring Log	SILTY SAND	10			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	2.8	83.0	14.2		
⊠	5.1	79.8	15.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.848	0.62	0.30	0.16	
⊠	1.235	0.84	0.36	0.15	



Job No. **XL-2201** Date **April 8, 2005**

Hole No. **SS-5-04** Sheet **1** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

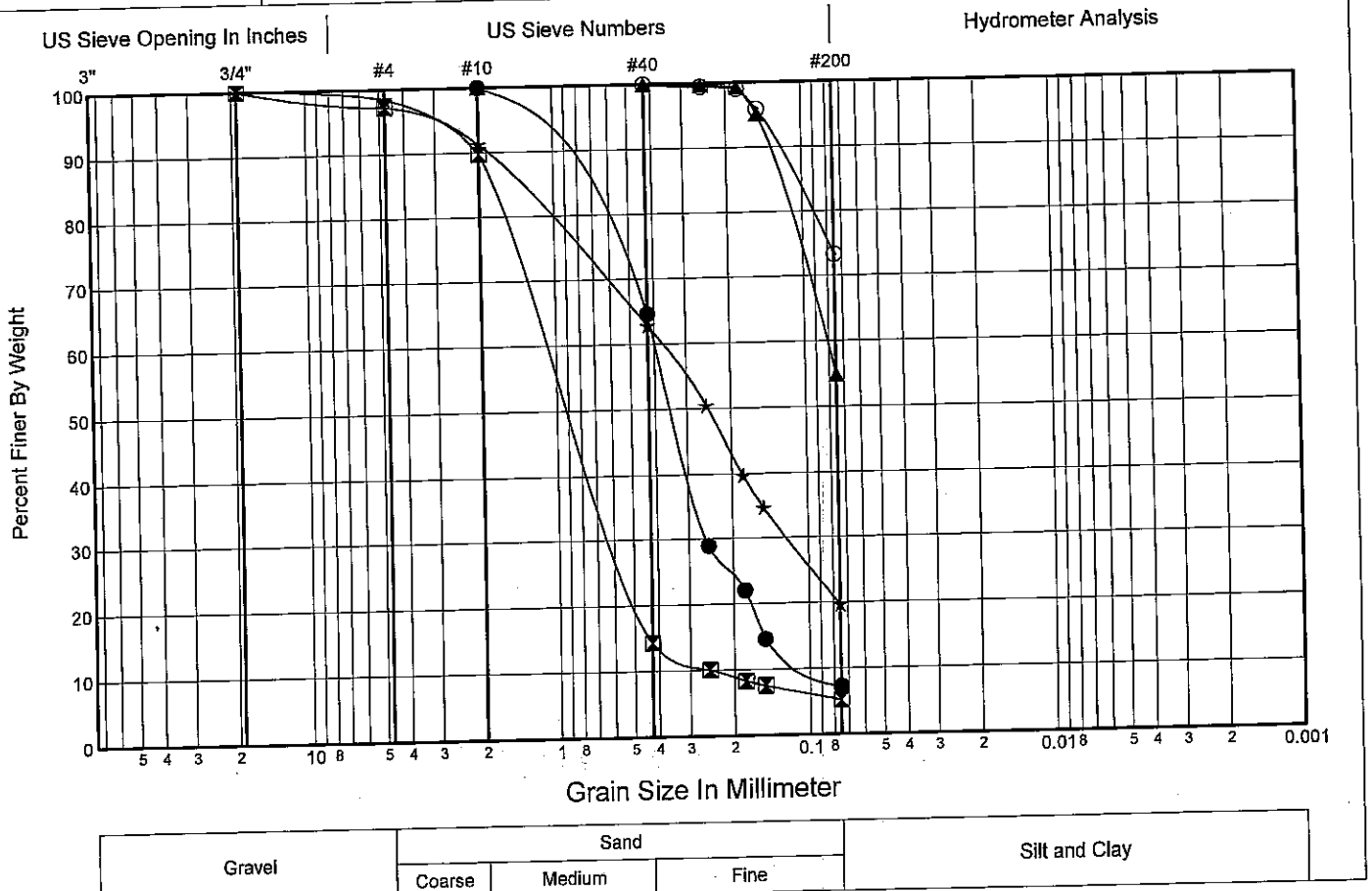
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	13.0	3.96	D-3	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	23			
⊠	38.0	11.58	D-8	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	20			
▲	53.0	16.15	D-11	ML	See Boring Log	SANDY SILT	22			
★	68.0	20.73	D-14	SM	See Boring Log	SILTY SAND	14			
⊙	78.0	23.77	D-16	ML	See Boring Log	SILT with SAND	33			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	92.8	7.2	1.7	4.1
⊠	2.7	92.0	5.2	1.3	4.3
▲	0.0	45.2	54.8		
★	1.5	78.9	19.6		
⊙	0.0	26.8	73.2		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.397	0.34	0.25	0.17	0.097
⊠	1.087	0.89	0.59	0.48	0.250
▲	0.082				
★	0.377	0.25	0.12	0.08	
⊙					



Job No. **XL-2201** Date **April 8, 2005**

Hole No. **SS-5-04** Sheet **2** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

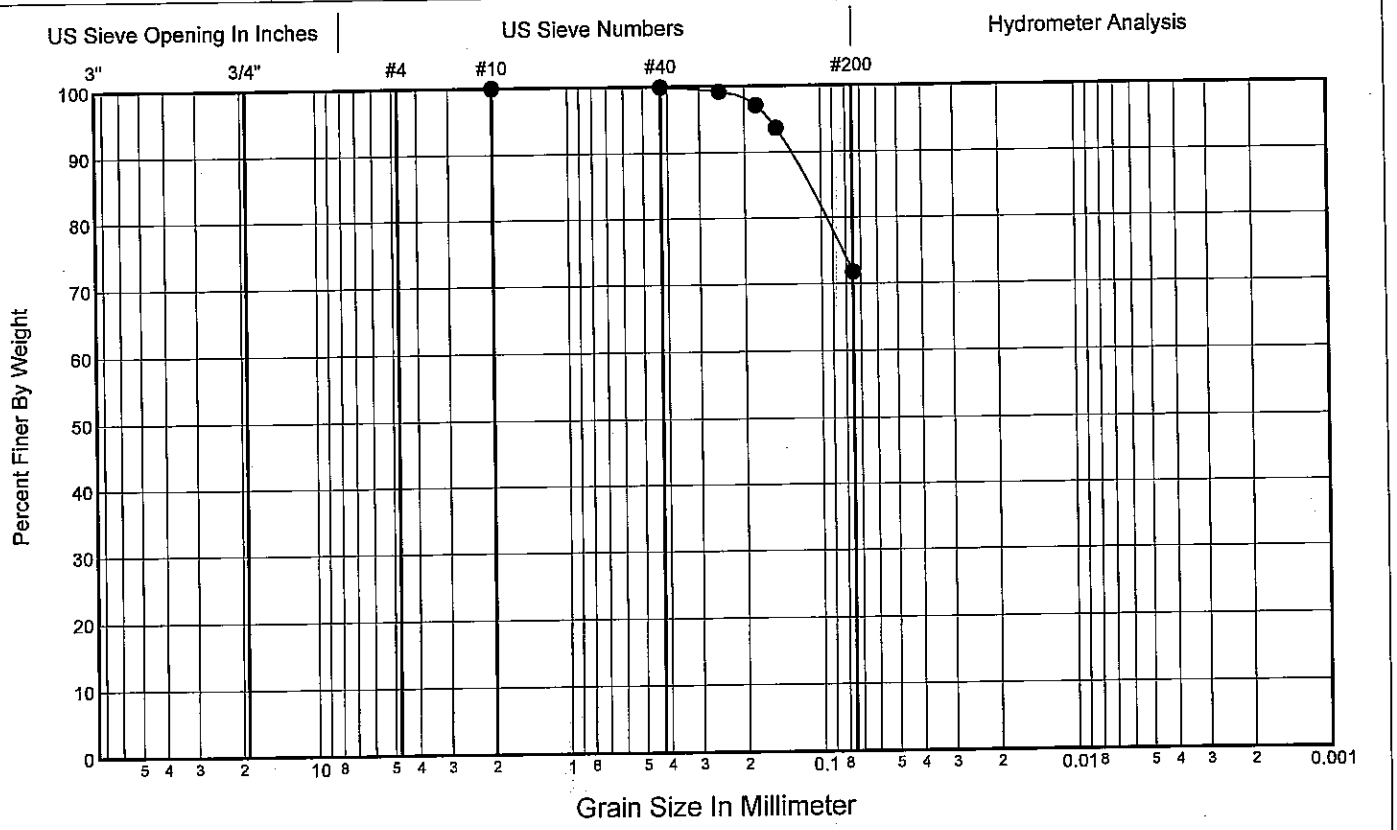
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	83.0	25.30	D-17	ML	See Boring Log	SILT with SAND	32			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	28.3	71.7		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					



Job No. **XL-2201** Date **April 12, 2005**

Hole No. **SS-6-04** Sheet **1** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

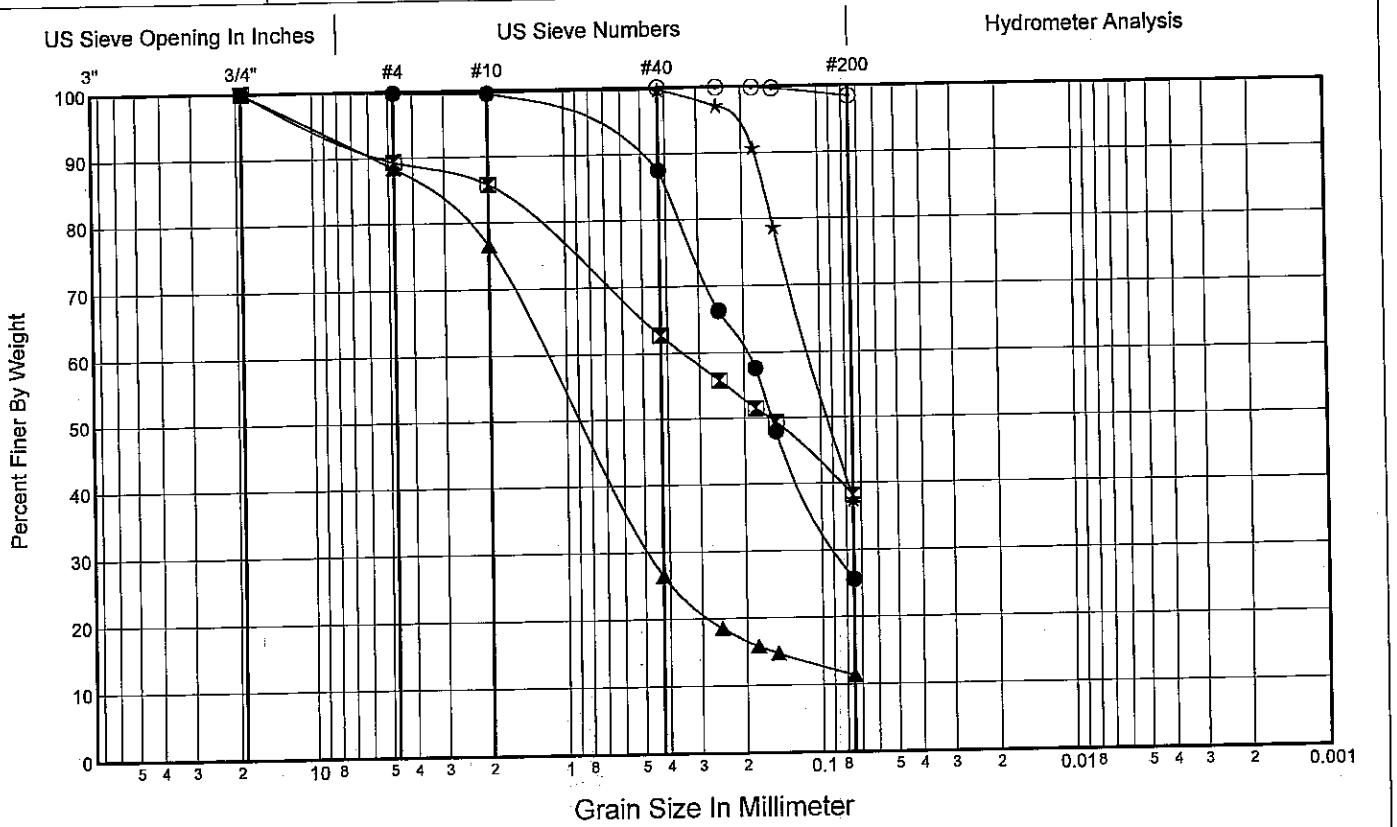
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	7.0	2.13	D-3	SM	See Boring Log	SILTY SAND	15			
⊠	9.0	2.74	D-4	SM	See Boring Log	SILTY SAND	14			
▲	17.0	5.18	D-7	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	16			
★	22.0	6.71	D-9	SM	See Boring Log	SILTY SAND	22			
⊙	27.0	8.23	D-11	CH	See Boring Log	FAT CLAY	35	60	29	31

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.2	74.2	25.6		
⊠	10.7	51.2	38.1		
▲	11.6	77.0	11.3	3.3	20.9
★	0.2	62.3	37.5		
⊙	0.0	1.6	98.4		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.197	0.16	0.09		
⊠	0.346	0.16			
▲	1.200	0.88	0.47	0.28	
★	0.110	0.09			
⊙					



Job No. **XL-2201** Date **April 12, 2005**

Hole No. **SS-6-04** Sheet **2** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

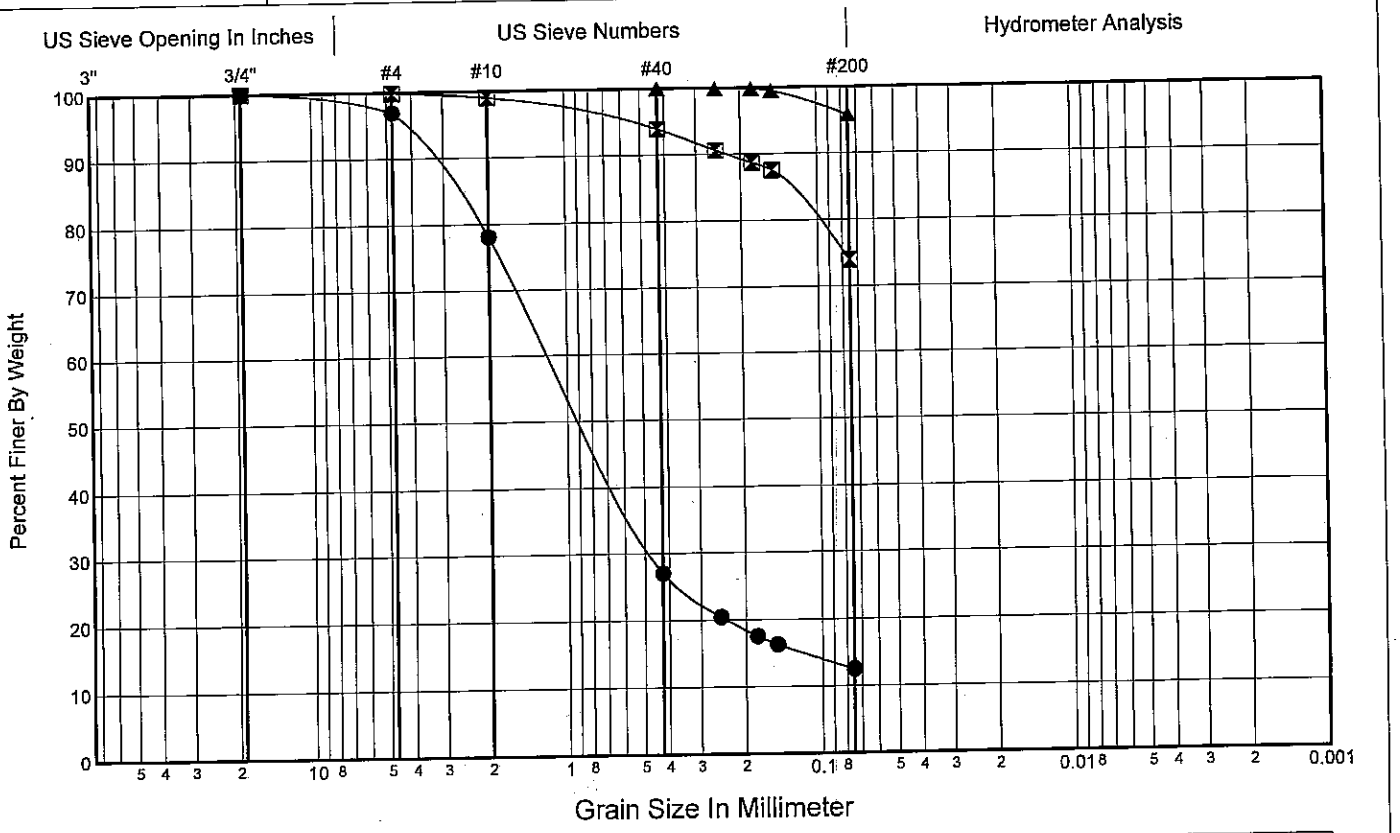
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	29.5	8.99	D-12	SM	See Boring Log	SILTY SAND	15			
⊠	39.0	11.89	D-14	ML	See Boring Log	SILT with SAND	30	44	31	13
▲	54.0	16.46	D-17	MH	See Boring Log	ELASTIC SILT	36	50	30	20

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	3.1	84.5	12.4	3.9	24.2
⊠	0.1	26.0	73.9		
▲	0.0	4.3	95.7		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	1.157	0.85	0.47	0.24	
⊠					
▲					



Job No. **XL-2201** Date **April 12, 2005**

Hole No. **SS-7-05** Sheet **1** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

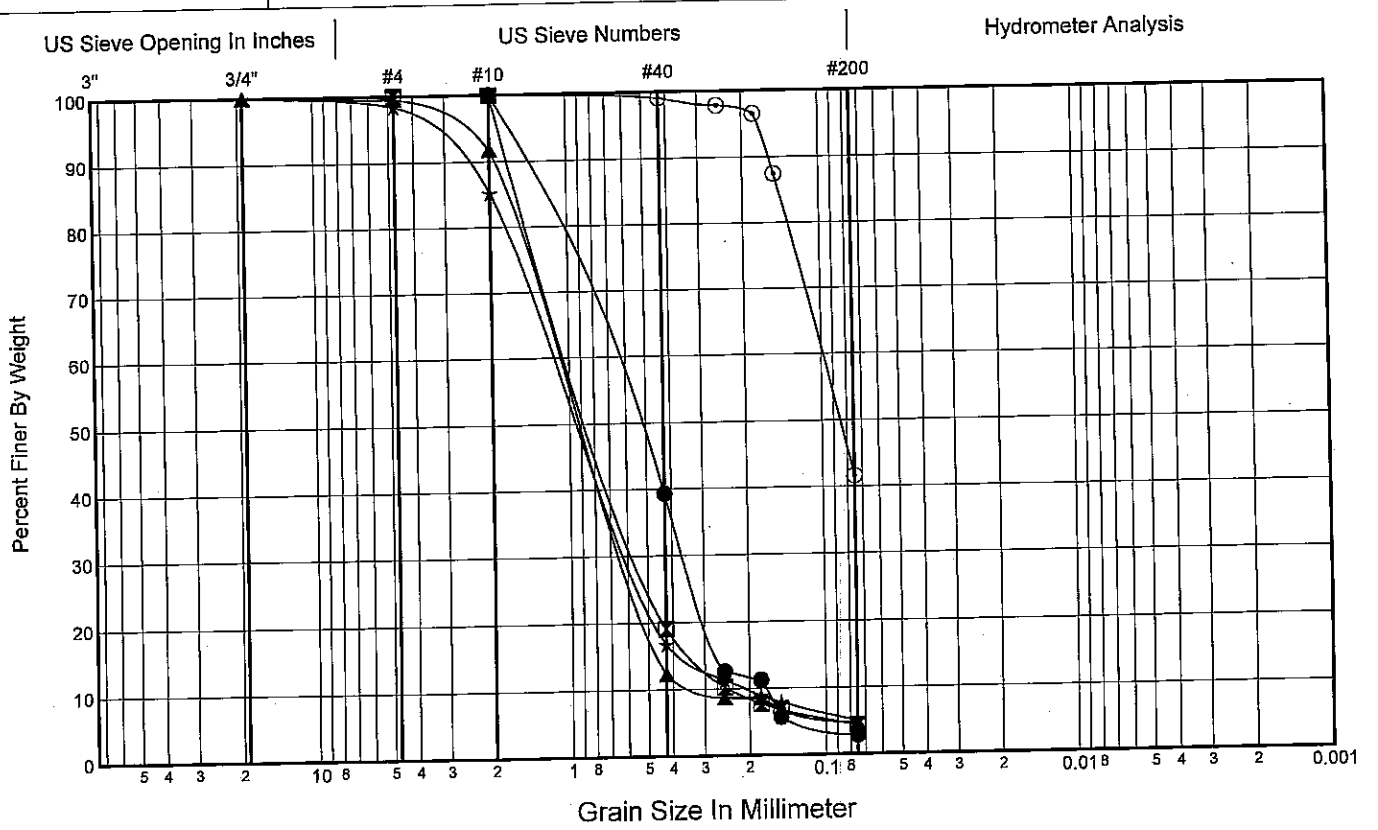
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	29.0	8.84	D-6	SP	See Boring Log	POORLY GRADED SAND	22			
⊠	41.5	12.65	D-9	SP	See Boring Log	POORLY GRADED SAND	19			
▲	49.0	14.94	D-12	SP	See Boring Log	POORLY GRADED SAND	14			
★	56.5	17.22	D-15	SP	See Boring Log	POORLY GRADED SAND	17			
⊙	64.0	19.51	D-18	SM	See Boring Log	SILTY SAND	30			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	97.2	2.8	1.0	4.2
⊠	0.0	95.6	4.4	1.2	3.8
▲	0.5	94.9	4.7	1.1	3.5
★	1.6	93.5	5.0	1.4	5.4
⊙	0.0	58.4	41.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.721	0.56	0.35	0.29	0.173
⊠	0.931	0.77	0.52	0.43	0.242
▲	1.079	0.89	0.60	0.49	0.307
★	1.132	0.90	0.57	0.46	0.209
⊙	0.099	0.09			



Job No. **XL-2201** Date **April 12, 2005**

Hole No. **SS-7-05** Sheet **2** of **2**

Project **NSLAC - Shady Slope Structures**

Laboratory Summary

Washington State Department of Transportation

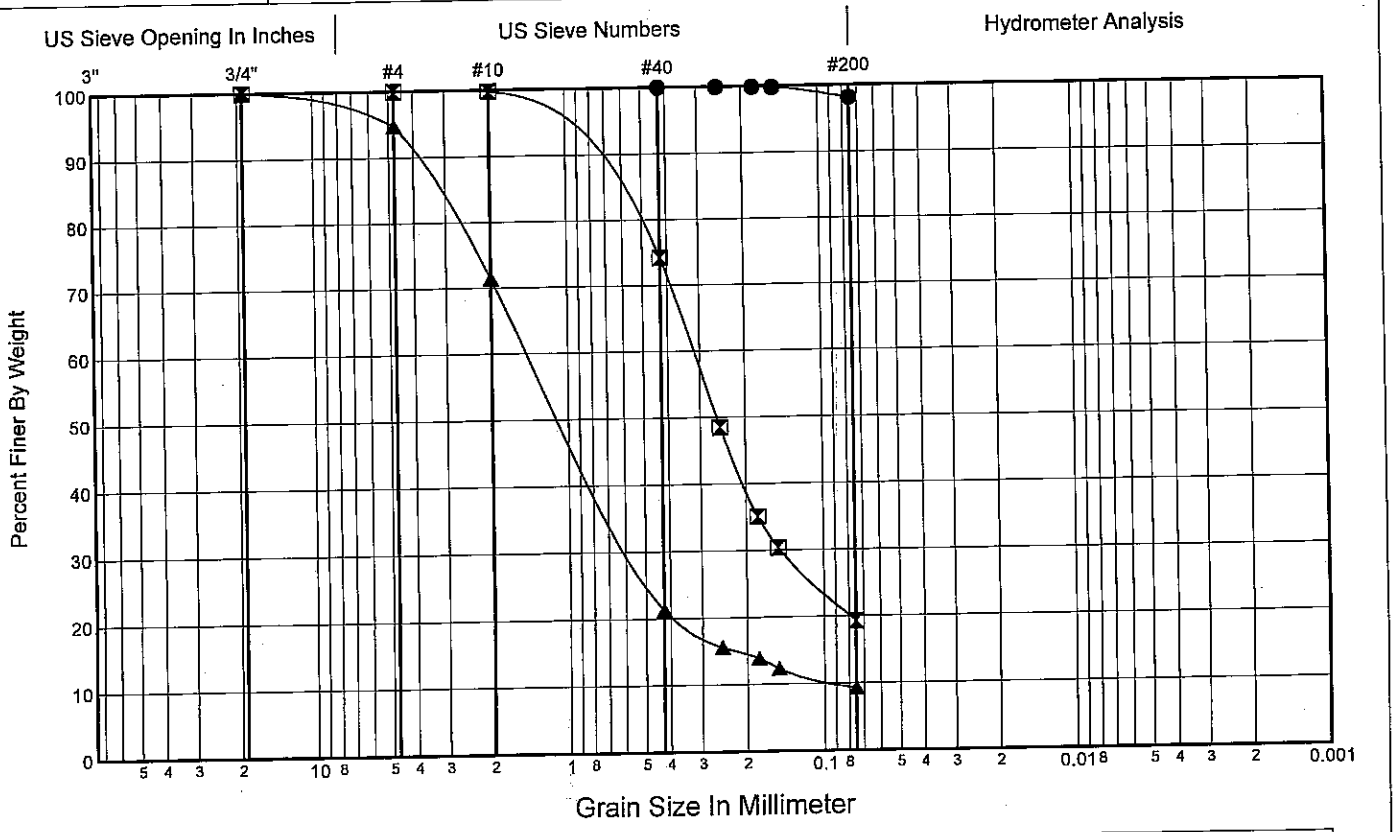
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	74.0	22.56	D-21	CL	See Boring Log	LEAN CLAY	37	32	20	12
⊠	79.0	24.08	D-23	SM	See Boring Log	SILTY SAND	22			
▲	89.0	27.13	D-25	SW-SM	See Boring Log	WELL-GRADED SAND with SILT	15			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	1.9	98.1		
⊠	0.0	80.7	19.3		
▲	5.3	85.5	9.2	2.5	15.8

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠	0.317	0.26	0.15	0.08	
▲	1.409	1.03	0.56	0.38	0.089

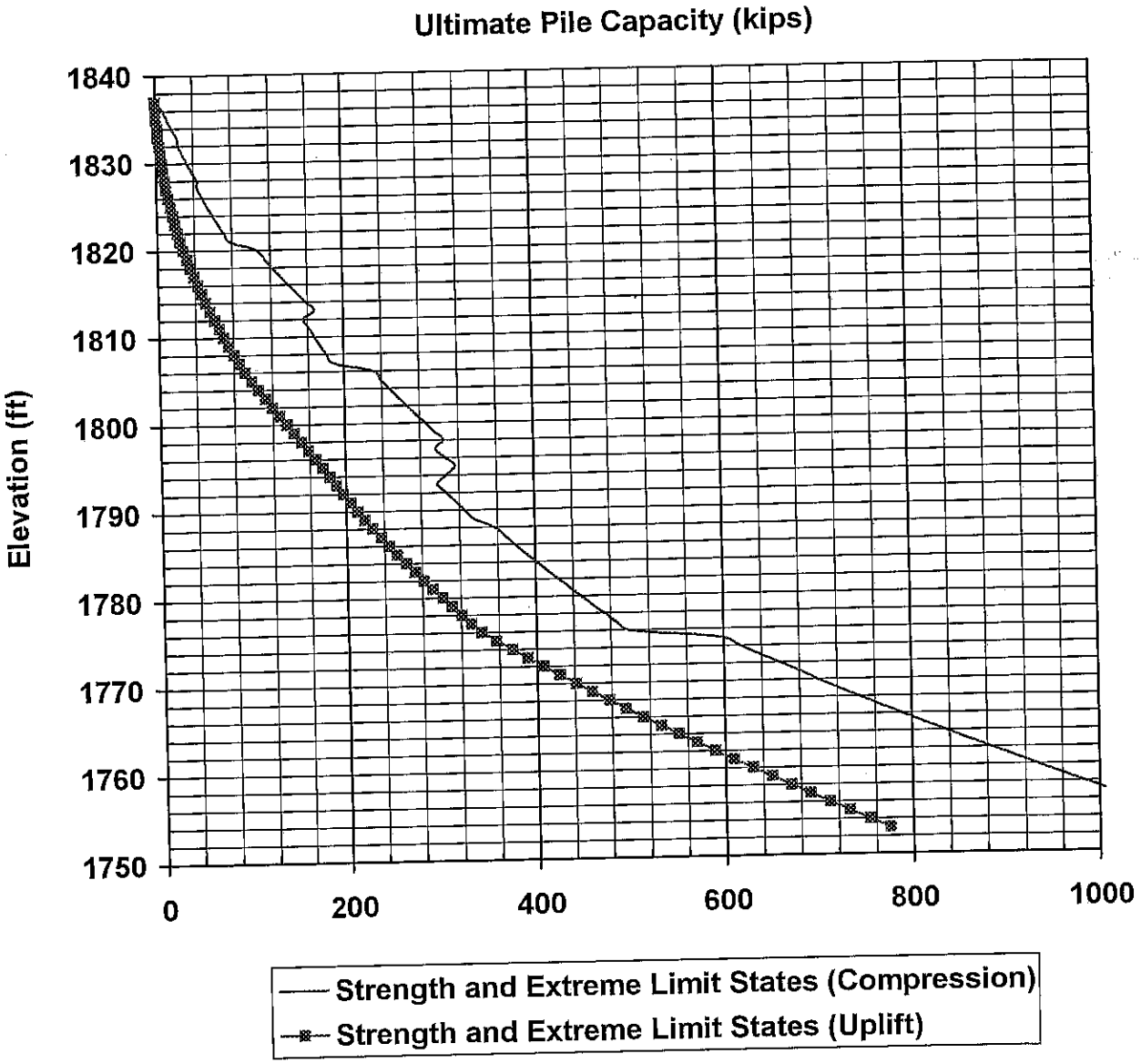


APPENDIX D

PILE CAPACITY CHARTS AND P-Y DATA FOR THE US 2 UNDERCROSSING AT SHADY SLOPE

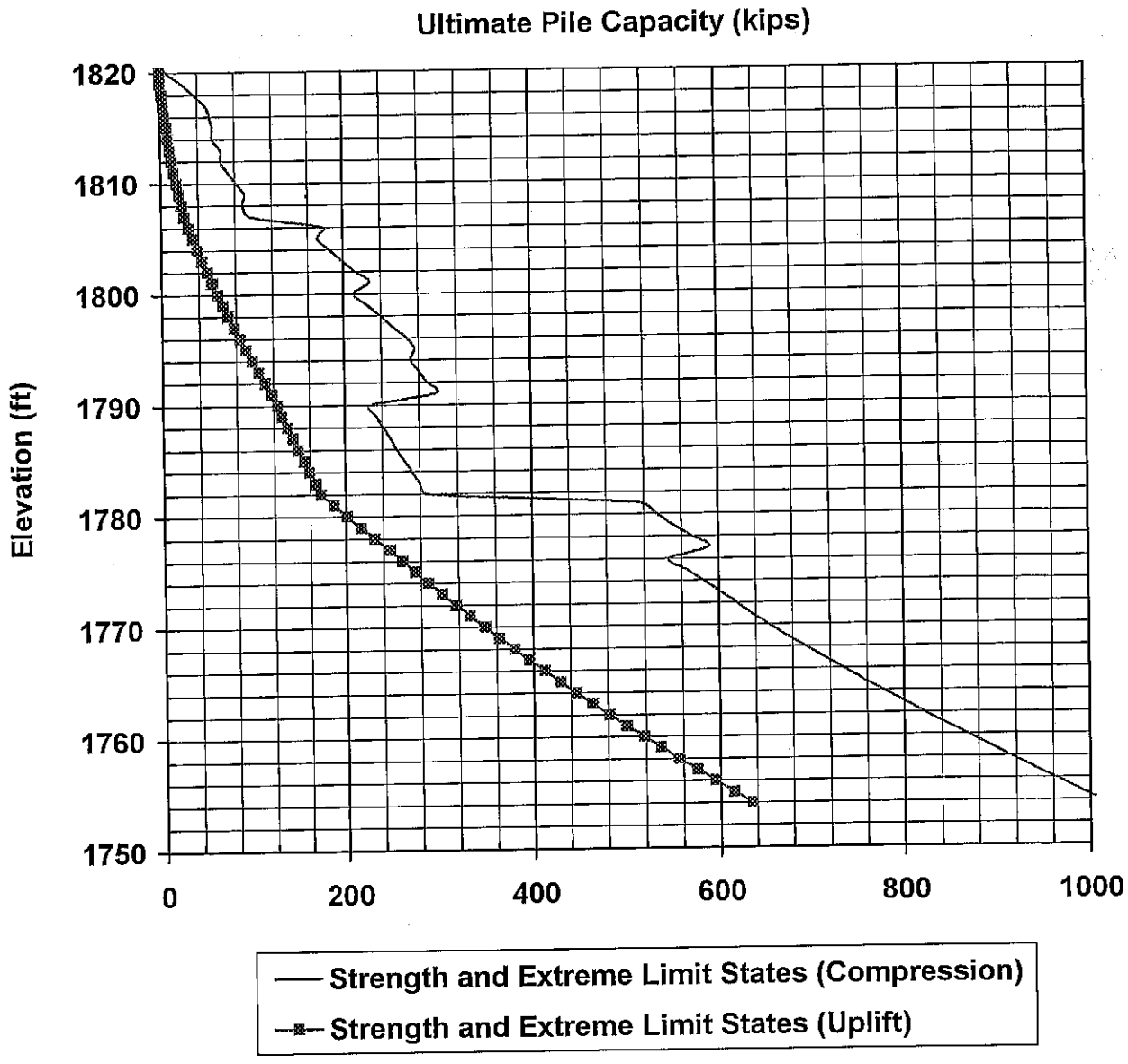
SR 395 - NSLAC - SR 2 U'xing at Shady Slope - SS-1-04 - Pier 1

Diameter 18 IN



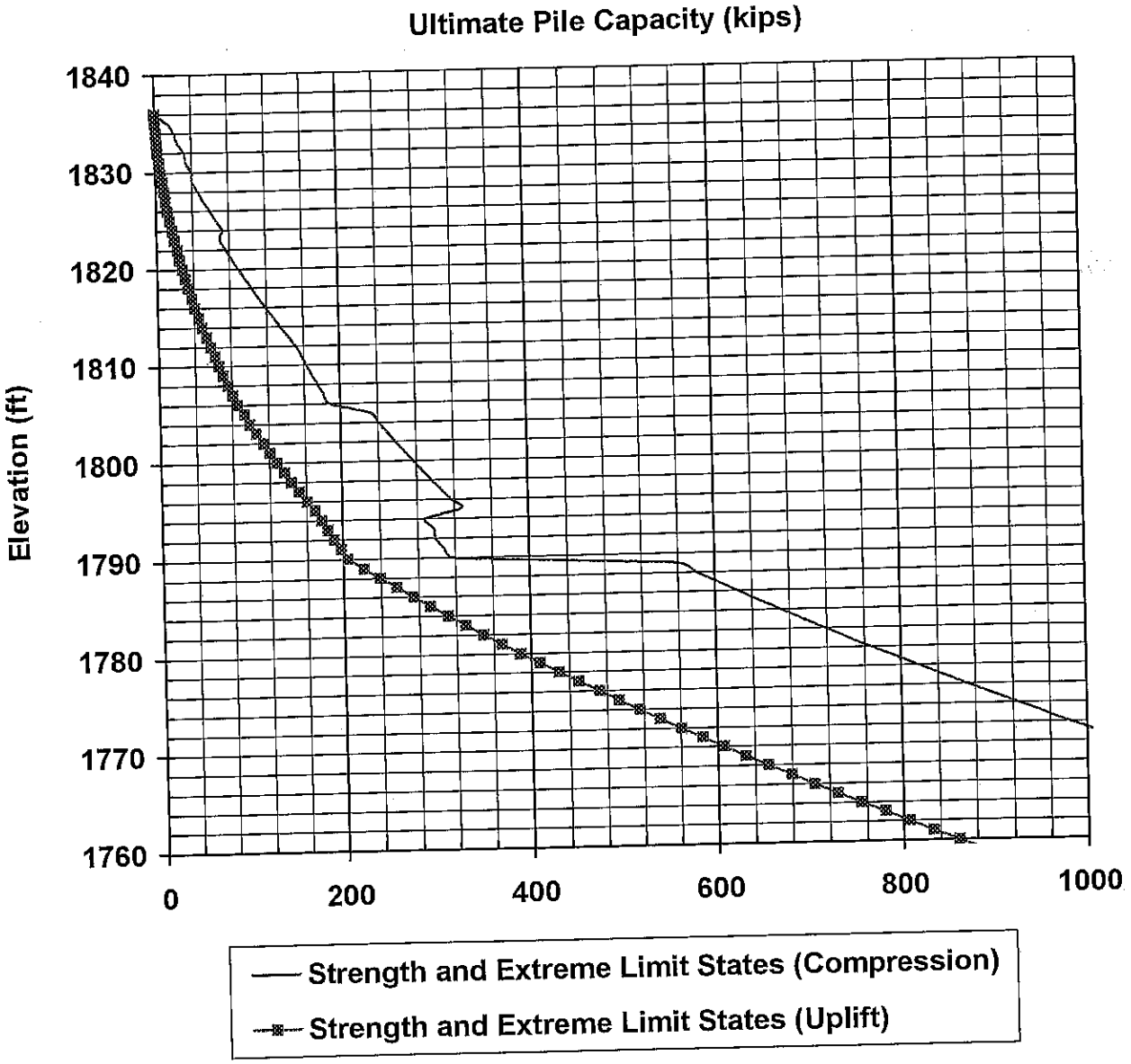
SR 395 - NSLAC - SR 2 U'xing at Shady Slope - SS-2-04 - Pier 2

Diameter 18 IN



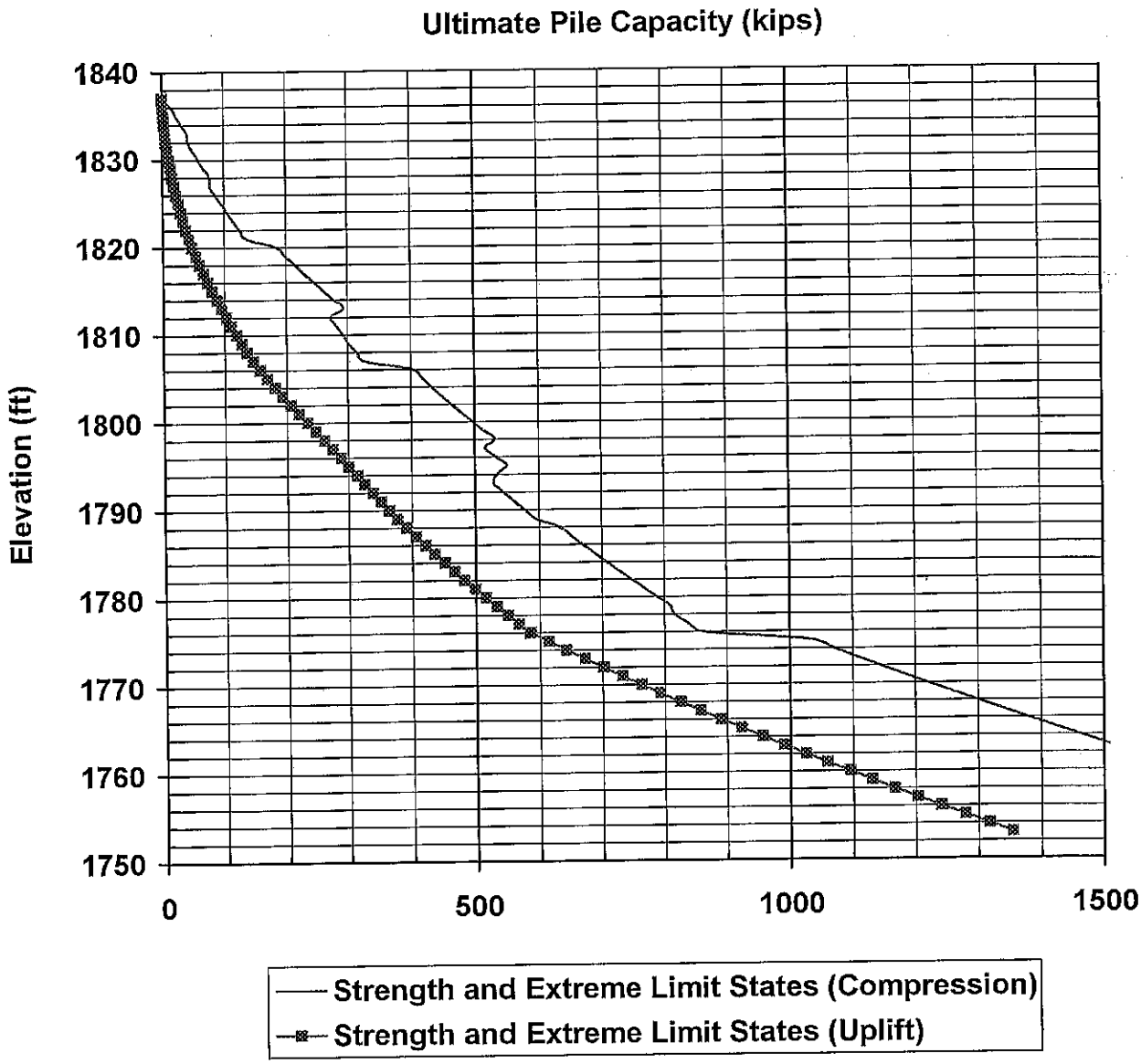
SR 395 - NSLAC - SR 2 U'xing at Shady Slope - SS-3-04 - Pier 3

Diameter 18 IN



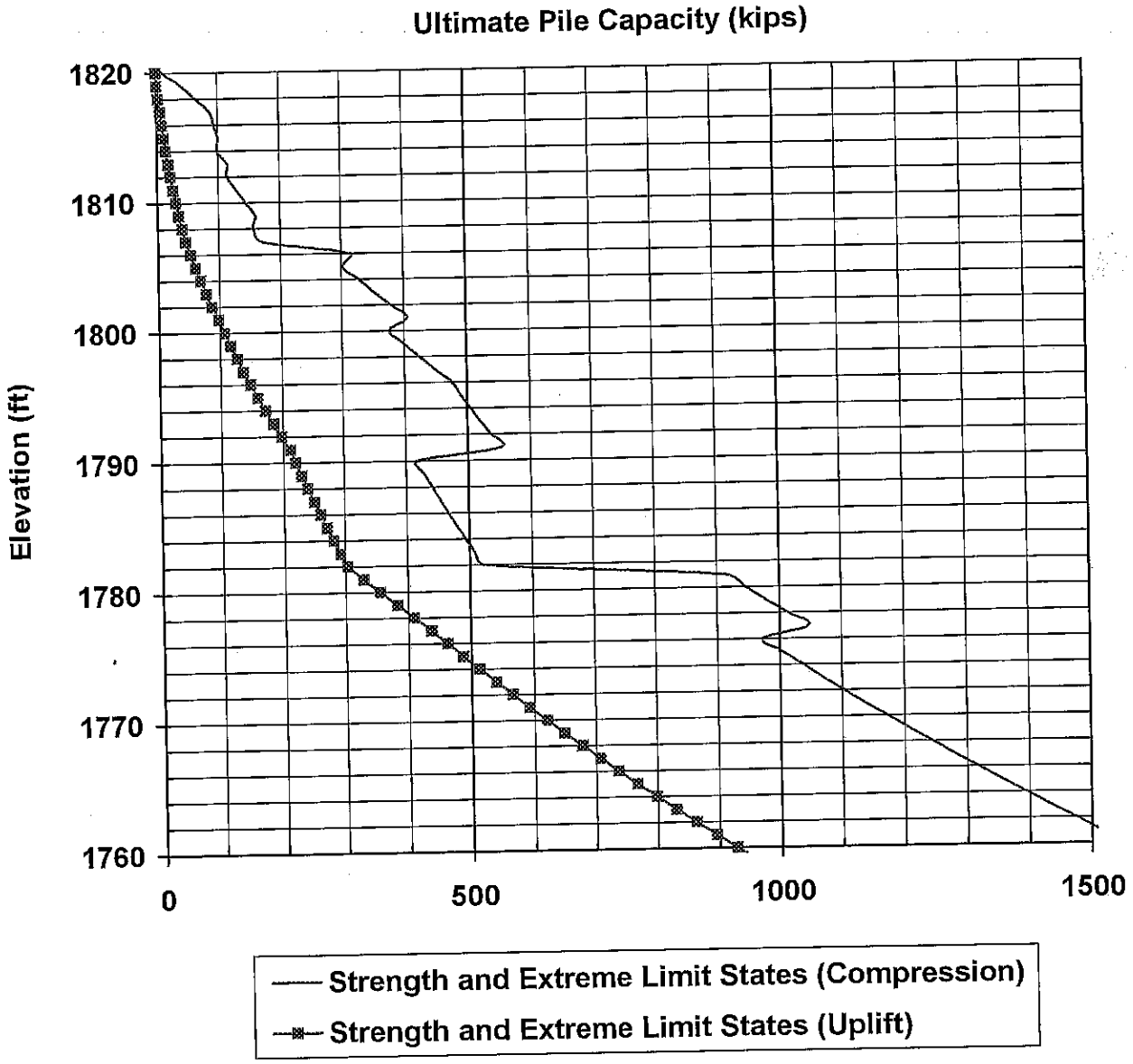
SR 395 - NSLAC - SR 2 U'xing at Shady Slope - SS-1-04 - Pier 1

Diameter 24 IN



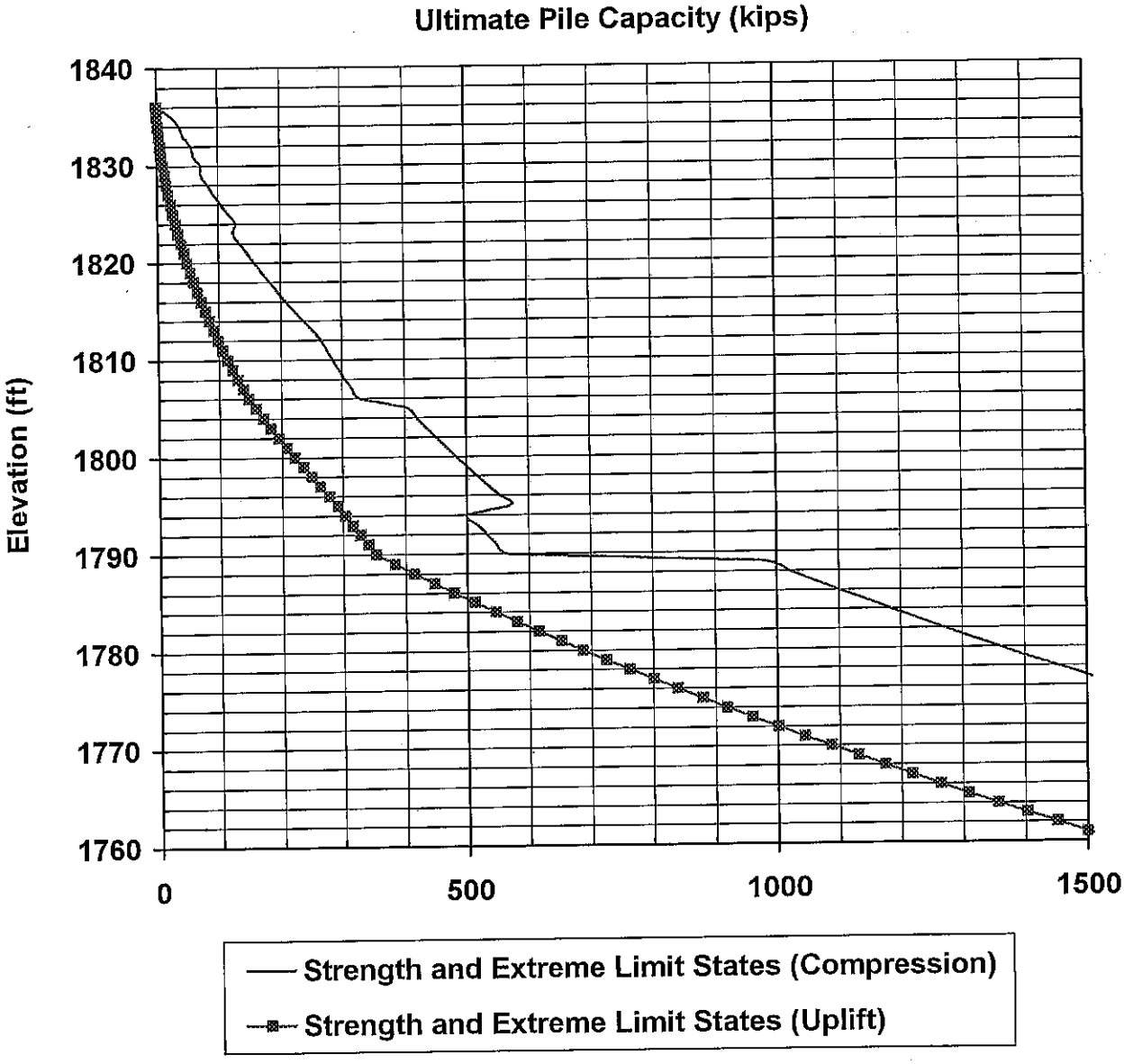
SR 395 - NSLAC - SR 2 U'xing at Shady Slope - SS-2-04 - Pier 2

Diameter 24 IN



SR 395 - NSLAC - SR 2 U'xing at Shady Slope - SS-3-04 - Pier 3

Diameter 24 IN



US 2 Undercrossing at Shady Slope
P-Y Curve Parameters for LPILE Input - Static and Dynamic Analysis

Pier 1
Based on Broing SS-1-04

Soil Layer	Elevation	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil	Saturated Undrained Shear Strength, S_u	Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction
	(ft)			(pcf)	(psf)	(%)	(deg)	(pci)
1	1821 - 1837	SAND	4	125	0	-	29	10
2	1807 - 1820	SAND	4	125	0	-	30	45
3	1795 - 1806	SAND	4	125	0	-	31	58
4	1776 - 1794	SAND	4	125	0	-	29	10
5	1753 - 1775	SAND	4	130	0	-	34	112

Pier 2
Based on Broing SS-2-04

Soil Layer	Elevation	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil	Saturated Undrained Shear Strength, S_u	Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction
	(ft)			(pcf)	(psf)	(%)	(deg)	(pci)
1	1820 - 1838	SAND	4	125	0	-	33	92
2	1807 - 1819	SAND	4	125	0	-	32	72
3	1791 - 1806	SAND	4	125	0	-	34	112
4	1782 - 1790	SAND	4	125	0	-	30	45
5	1754 - 1781	SAND	4	130	0	-	35	135

Pier 3
Based on Broing SS-3-04

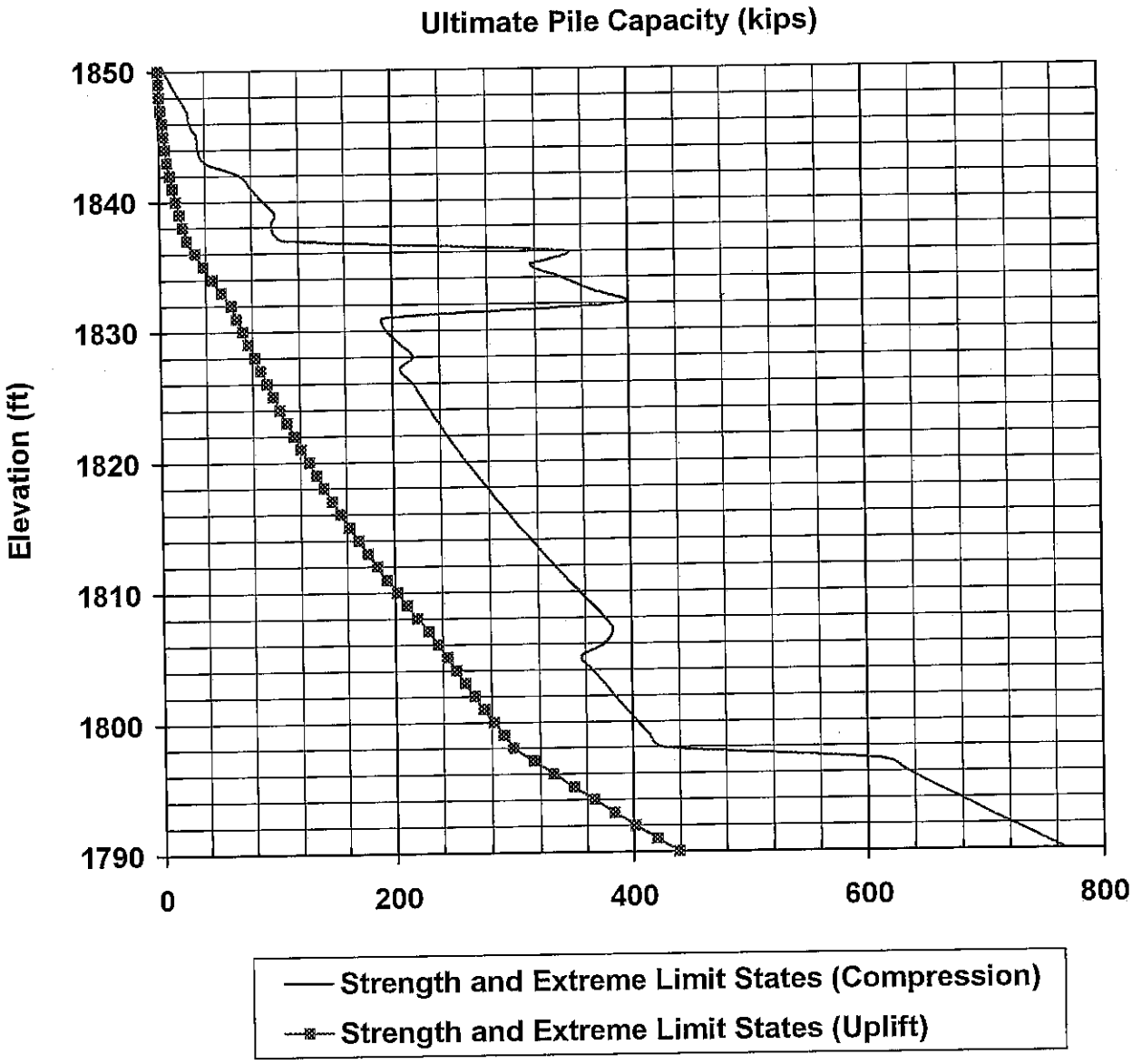
Soil Layer	Elevation	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil	Saturated Undrained Shear Strength, S_u	Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction
	(ft)			(pcf)	(psf)	(%)	(deg)	(pci)
1	1806 - 1836	SAND	4	125	0	-	30	45
2	1795 - 1805	SAND	4	125	0	-	32	72
3	1790 - 1794	CLAY	2	125	0	-	29	10
4	1752 - 1789	SAND	4	125	0	-	36	180

APPENDIX E

PILE CAPACITY CHARTS AND P-Y DATA FOR THE US 395 UNDERCROSSING AT SHADY SLOPE

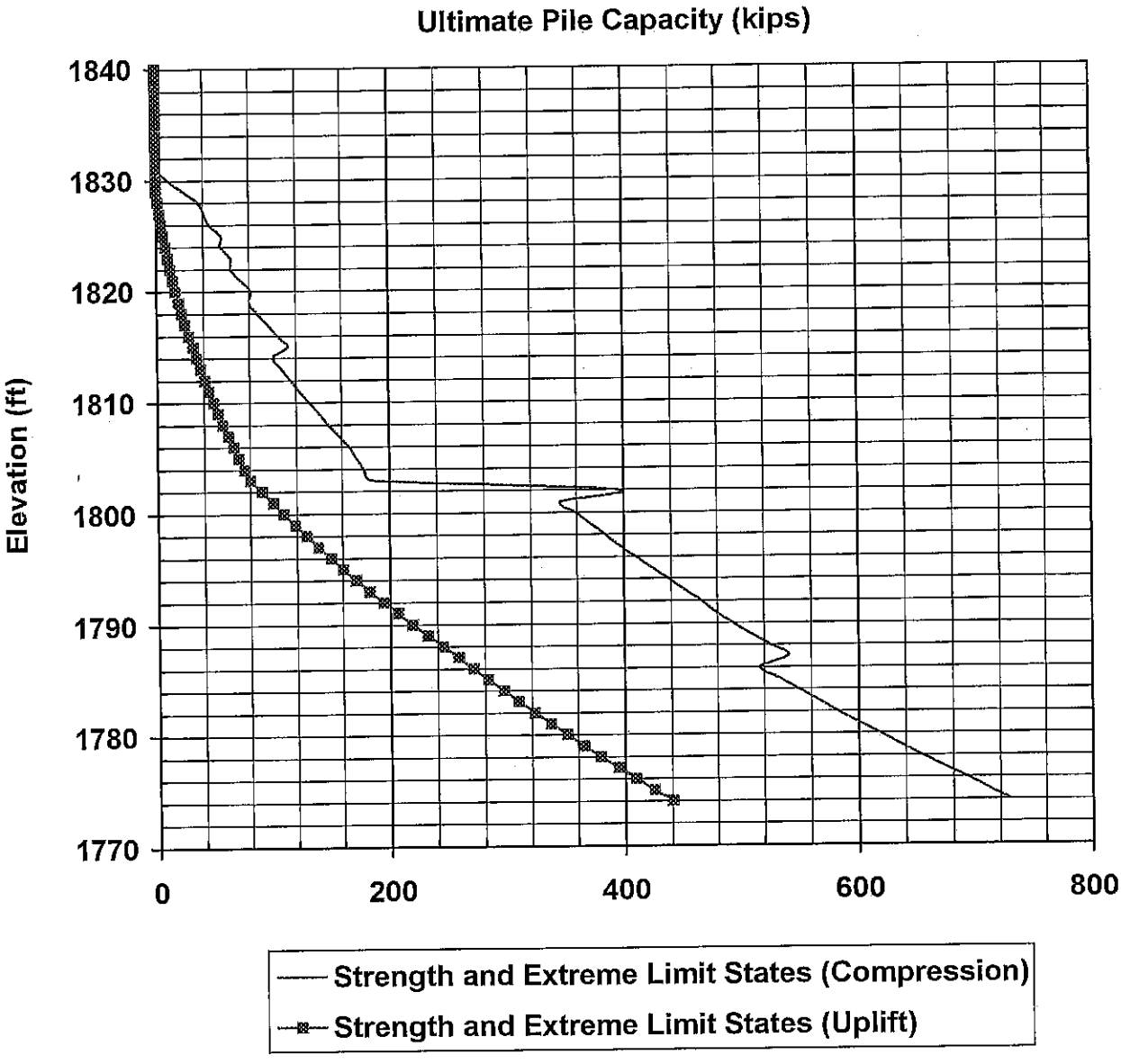
SR 395 - NSLAC - SR 395 U'xing at Shady Slope - SS-7-04 - Pier 1

Diameter 18 IN



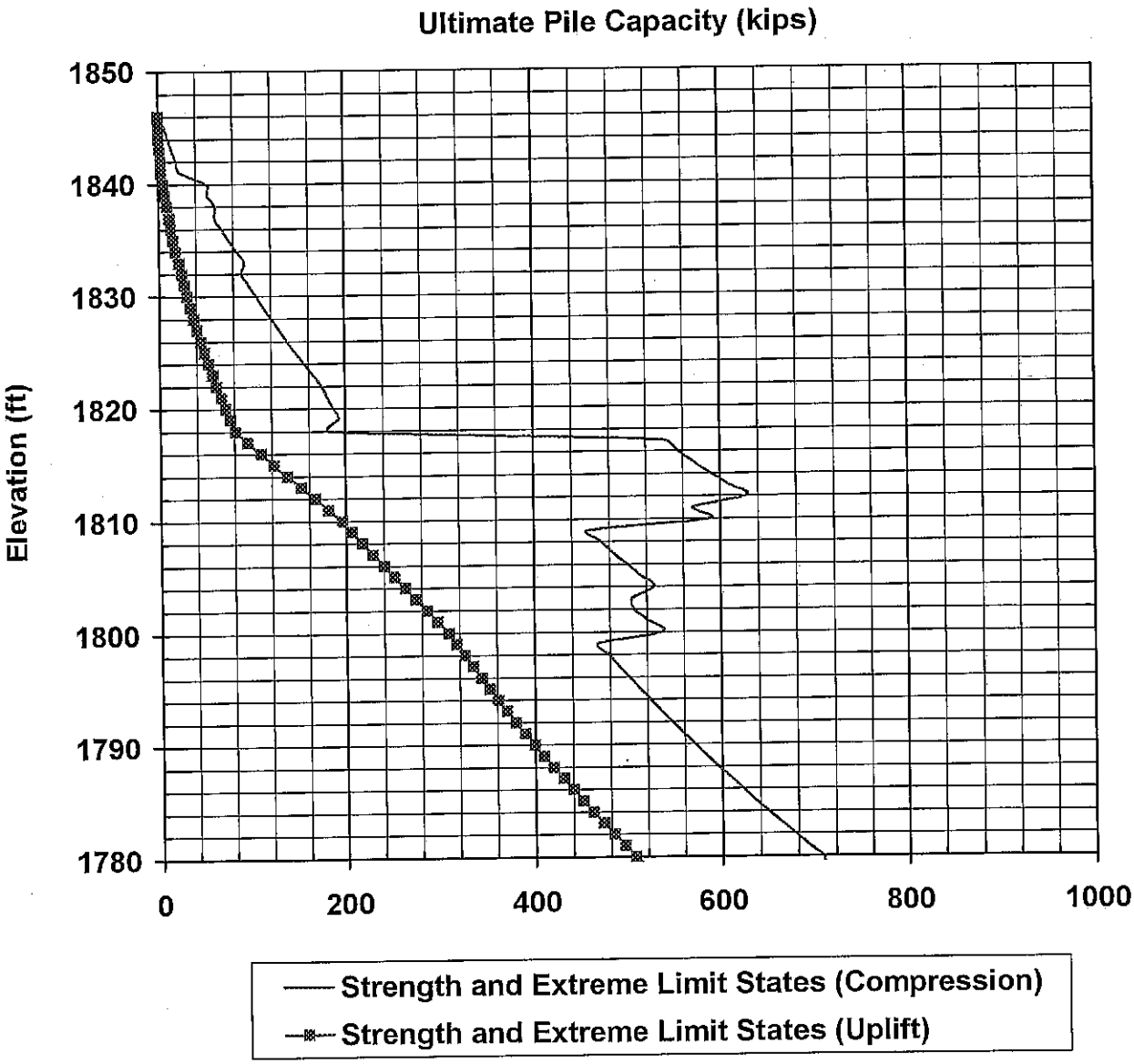
SR 395 - NSLAC - SR 395 U'xing at Shady Slope - SS-5-04 - Pier 2

Diameter 18 IN



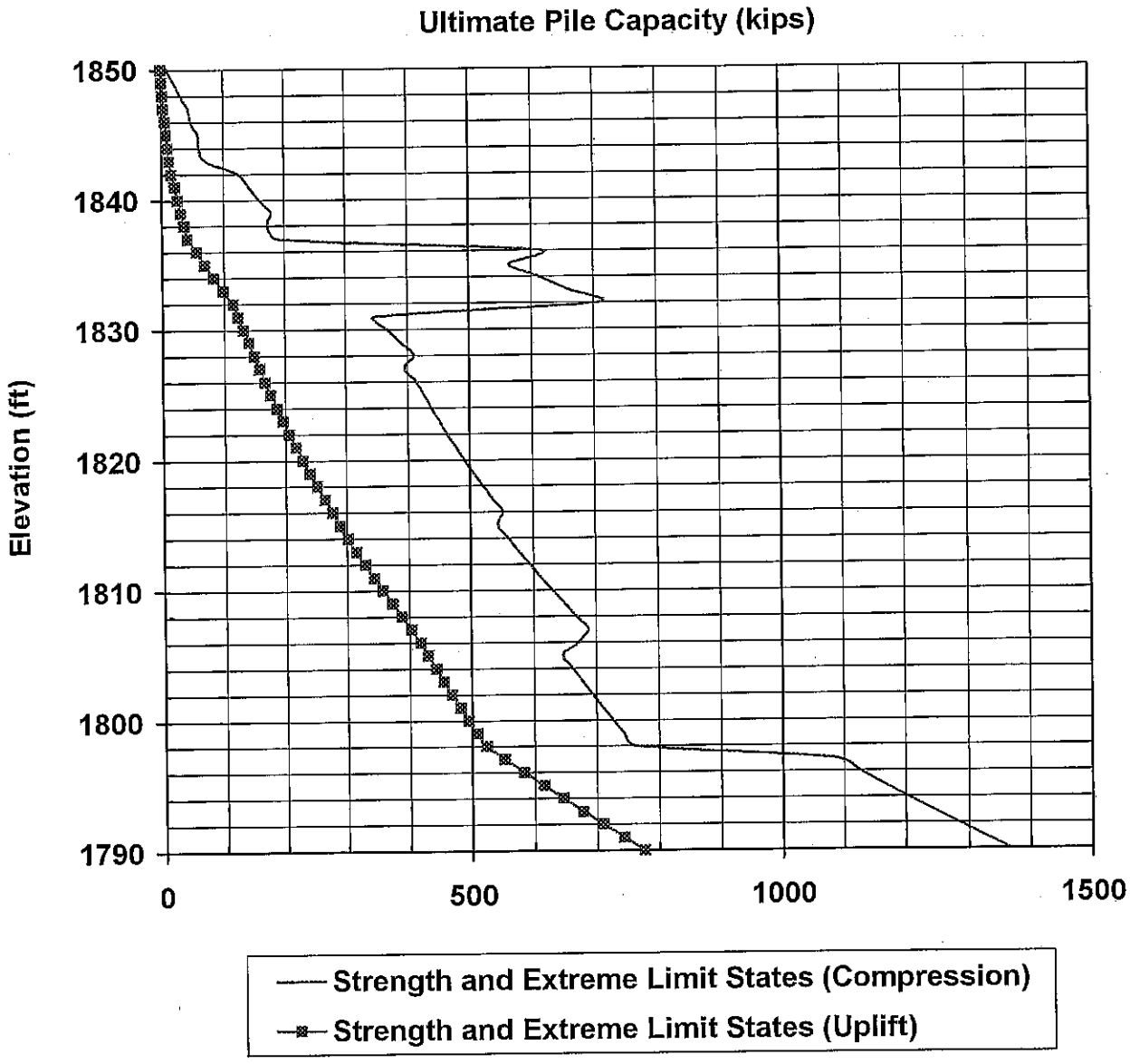
SR 395 - NSLAC - SR 395 U'xing at Shady Slope - SS-6-04 - Pier 3

Diameter 18 IN



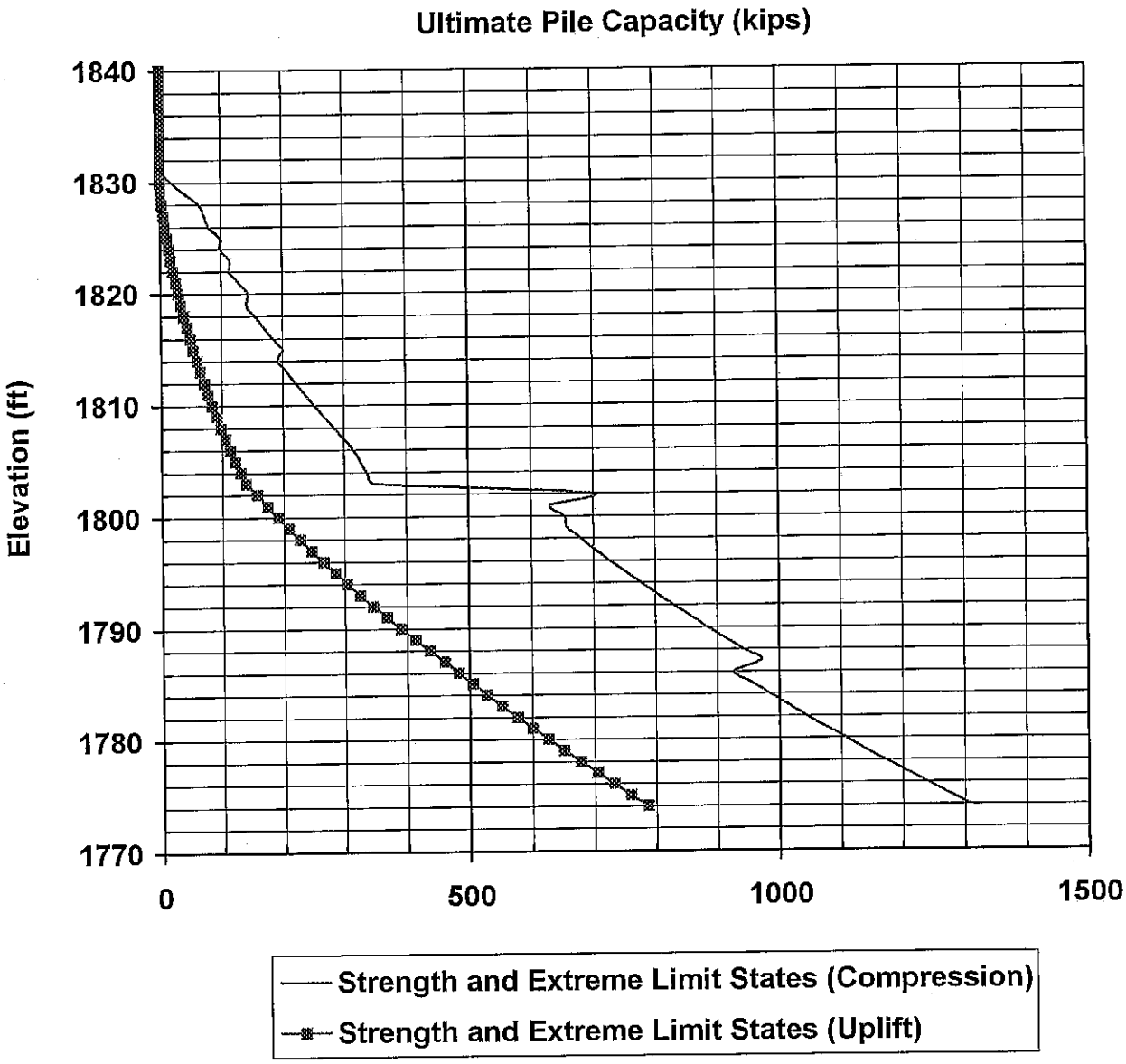
SR 395 - NSLAC - SR 395 U'xing at Shady Slope - SS-7-04 - Pier 1

Diameter 24 IN



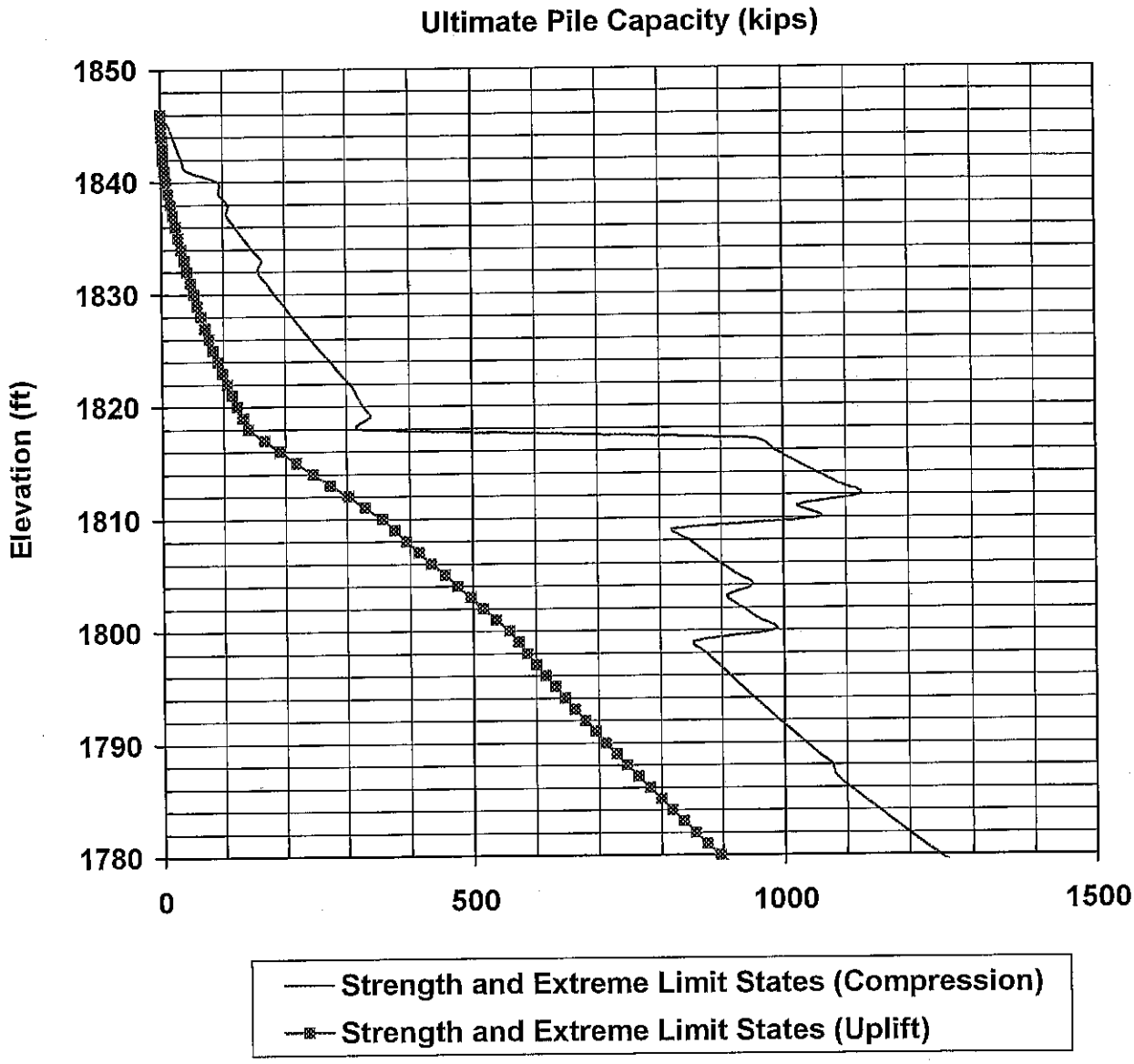
SR 395 - NSLAC - SR 395 U'xing at Shady Slope - SS-5-04 - Pier 2

Diameter 24 IN



SR 395 - NSLAC - SR 395 U'xing at Shady Slope - SS-6-04 - Pier 3

Diameter 24 IN



US 395 Undercrossing at Shady Slope
P-Y Curve Parameters for LPILE Input - Static and Dynamic Analysis

Pier 1
Based on Broing SS-7-04

Soil Layer	Elevation	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil	Saturated Undrained Shear Strength, S_u	Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction
	(ft)			(pcf)	(psf)	(%)	(deg)	(pci)
1	1843 - 1874	SAND	4	125	0	-	32	72
2	1837 - 1842	SAND	4	125	0	-	33	92
3	1832 - 1836	SAND	4	125	0	-	38	200
4	1806 - 1831	SAND	4	125	0	-	31	58
5	1798 - 1805	CLAY	2	125	0	-	28	10
6	1790 - 1797	SAND	4	130	0	-	36	158

Pier 2
Based on Broing SS-5-04

Soil Layer	Elevation	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil	Saturated Undrained Shear Strength, S_u	Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction
	(ft)			(pcf)	(psf)	(%)	(deg)	(pci)
1	1833 - 1858	SAND	4	125	0	-	30	45
2	1803 - 1832	SAND	4	125	0	-	32	72
3	1785 - 1802	SAND	4	125	0	-	36	158
4	1774 - 1784	SAND	4	125	0	-	35	135

Pier 3
Based on Broing SS-6-04

Soil Layer	Elevation	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight of Soil	Saturated Undrained Shear Strength, S_u	Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction
	(ft)			(pcf)	(psf)	(%)	(deg)	(pci)
1	1832 - 1837	SAND	4	125	0	-	30	45
2	1809 - 1831	SAND	4	125	0	-	31	58
3	1801 - 1808	SAND	4	125	0	-	38	200
4	1791 - 1800	SAND	4	130	0	-	34	92
5	1778 - 1790	SAND	4	130	0	-	30	45